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JOHN CREW

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Agriculture

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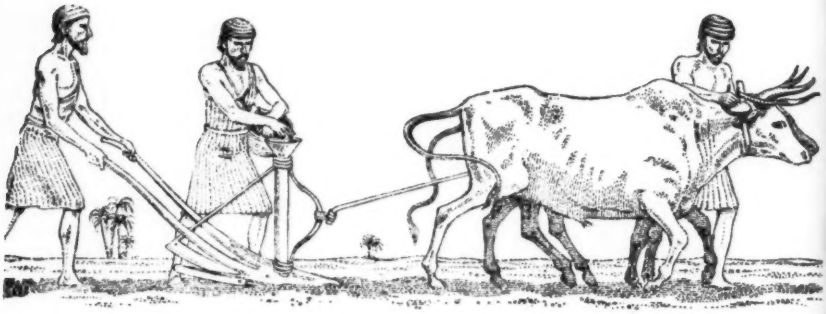
NINEPENCE MONTHLY

The Babylonians knew their drill



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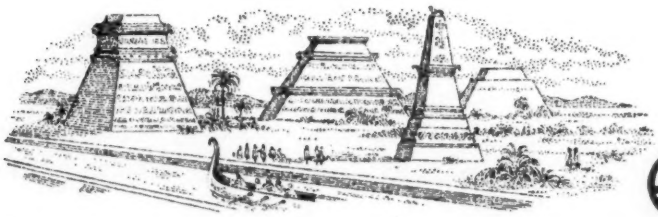

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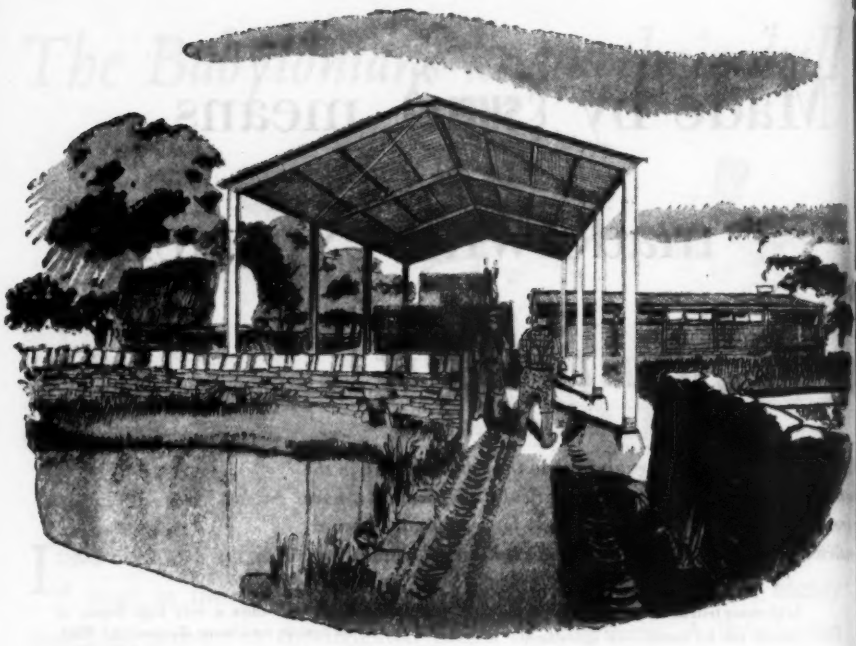

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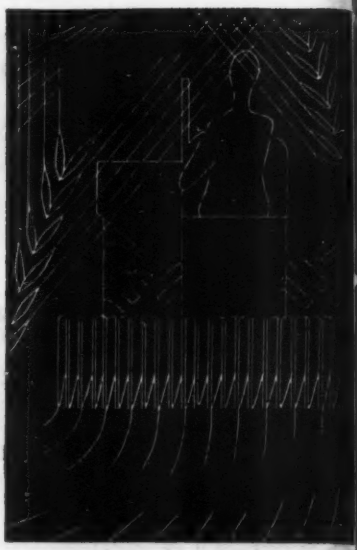

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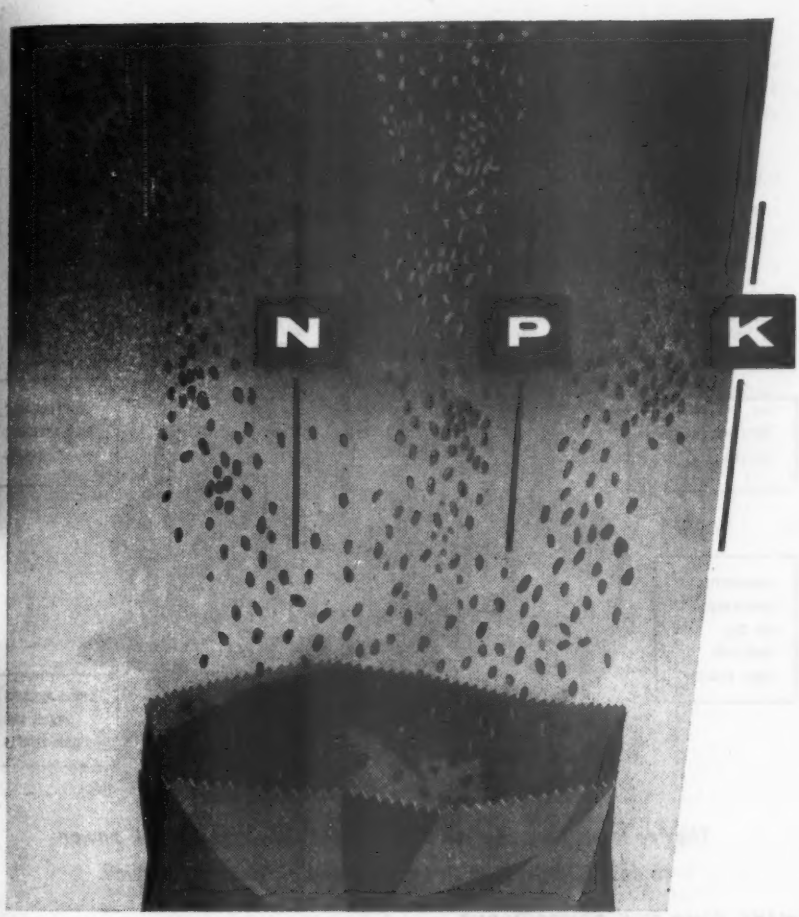

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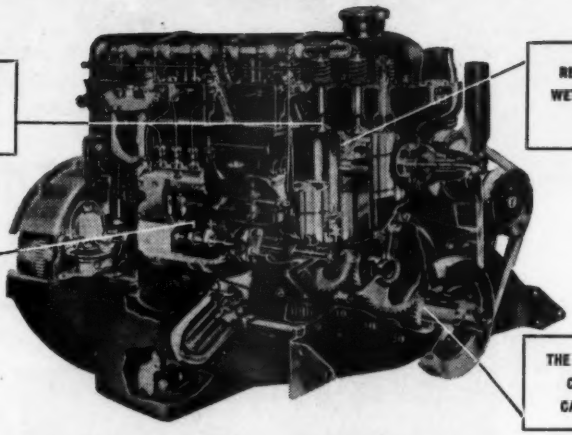
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AGRICULTURE

VOL. LXII No. 9 DECEMBER 1955

UTILIZATION OF GRASSLAND (2)

R. A. HAMILTON, B.SC., B.AGR., DIP. AGRIC.(Cantab.)

Imperial Chemical Industries Ltd.

The first part of this paper, read to the British Association in September, was published last month. Here Mr. Hamilton emphasizes the necessity for ensuring the closest possible dovetailing between pasture production and animal requiriements, and stresses the need for more silage.

WHAT are the rules for making the best use of grassland? I think one must admit at once that in this important field of grass utilization our information is woefully inadequate. There are great gaps in our knowledge and it must be true to say that we have just touched the fringe of the subject. The utilization of grass is, of course, closely linked with its production. The production of herbage is influenced by three groups of factors. Firstly, there are the natural factors of soil, climate, topography, etc., all of which affect the growth of grass through their effect on temperature, soil moisture and the like. Secondly, there are the inherent natural forces within the plant which control its characteristic cycle of growth. Lastly, there are management factors, which include the choice of species and strains of grass, the use of fertilizers to extend the growing season as well as to improve the yield and quality of herbage, cultural practices, frequency of sward defoliation, etc.

Of the three groups of factors, only the last is under the farmer's control, the other two being natural phenomena which together largely govern the characteristic pattern of grass growth and account for the marked fluctuation in herbage production during the growing season. Advances in plant breeding and grassland management have done much to even out this pattern of growth but still it confronts the farmer. Although he can normally hope to extend the grazing season by some 2-3 weeks in the spring, and again in the autumn, through the judicious use of fertilizers; though, too, he may increase his supply of herbage during midsummer by the use of maiden seeds and so on, he must nevertheless acknowledge that herbage production follows a characteristic seasonal pattern of growth over which he has only limited control.

The main problem of grass utilization is to obtain a close fit between the pattern of grass growth and the nutritional requirements of the livestock. The aim must be to consume the maximum proportion of the grass as grazing because, as was shown in Table 2 (last month), this is by far the cheapest method of using grass. It is seldom possible, however, to achieve so close a fit between pasture production and animal requirements that all the grass on a farm is consumed as grazing on an all-the-year-round basis. Other methods for using grass must therefore be adopted.

Examples from New Zealand One of the best natural fits between pasture production and animal requirements is seen in the fat lamb industry of New Zealand. This is illustrated in Fig. 1. The pasture shows the typical yield curve with a spring and early summer peak, followed by a lean period and then a smaller autumn peak, followed by a dormant winter period.

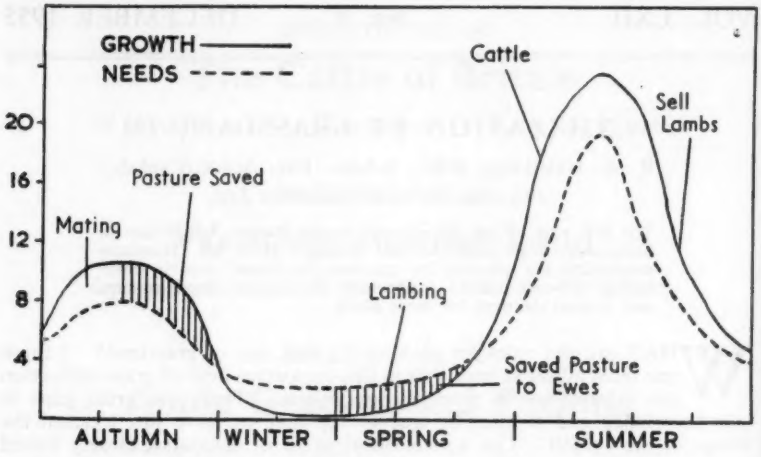

Fig. 1

Pasture Growth and Fat Lamb Flock Needs in New Zealand
(After McMeekan)

The New Zealand fat lamb farmer purchases cull ewes from the lower hills in late summer, and these are mated to lamb at the commencement of spring growth. A Southdown ram is used to give an early-maturing lamb, with the object of selling most of them fat off the mother at 16-20 weeks when pasture growth declines with dry summer weather. After weaning, the remaining lambs are given the best of the pasture and the ewes run on bare pasture to bring them down in condition. They are then run on better autumn pastures to flush them for tupping, and this is followed by bare maintenance during mid-pregnancy. During this period grass is saved and stored *in situ* for feeding off to the ewes during the pre-lambing period.

Stocking rates are high, varying from 4 to 6-8 ewes per acre, and the ewes and lambs are set stocked (that is, confined on individual fields from lambing to weaning), unless the lambs are sold fat before weaning. This may seem a surprising practice, since it might be expected that rotational grazing at these levels of stocking would give better results; but there seems no doubt that the young lamb thrives best under a set stocking system, even although at times the pasture may appear extremely bare.

In many cases cattle are introduced into the system when the growth of grass is nearing its peak. The cattle are rotationally grazed, their function being to keep the pasture at the right stage for the sheep. As the food declines they are sold fat. The cattle are only a tool in the system and add little or nothing to the financial returns, but they greatly facilitate efficient grass utilization.

Output of meat by this system is high; the liveweight gain ranging from 400 to 600 lb. per acre, and the total number of lambs produced now exceeds

ten million annually—a remarkable figure when it is realized that sheep were only introduced into New Zealand in 1773. In certain districts of New Zealand grass is not sufficient to supply all the winter requirements, and some arable crops (mainly roots) are grown, but for labour reasons the tendency is to try and extend the grazing season and rely on grass all the year round.

New Zealand fat lamb farming is one of the best examples of good grass utilization—grass production is at a high level and very little is wasted. The result is low cost production. The system, however, is not devoid of difficulties and there are many problems, the solution to which will further enhance production. In this system—as in all efficient grassland systems—it is recognized that the farmer must be prepared to punish the pastures (or the stock, if this is necessary), but at times when no irreparable damage is done and from which recovery can also be planned.

The New Zealand fat lamb farm is an example of almost a perfect fit between grass production and animal requirements. In the case of the New Zealand dairy farm, however, the fit between production and animal needs is more complicated, but none the less grass in some form provides for the full needs of the dairy herd in most cases, and the system is worth examination.

The cows are managed to calve in spring and their nutritional needs and pasture growth curves are shown in Fig. 2.

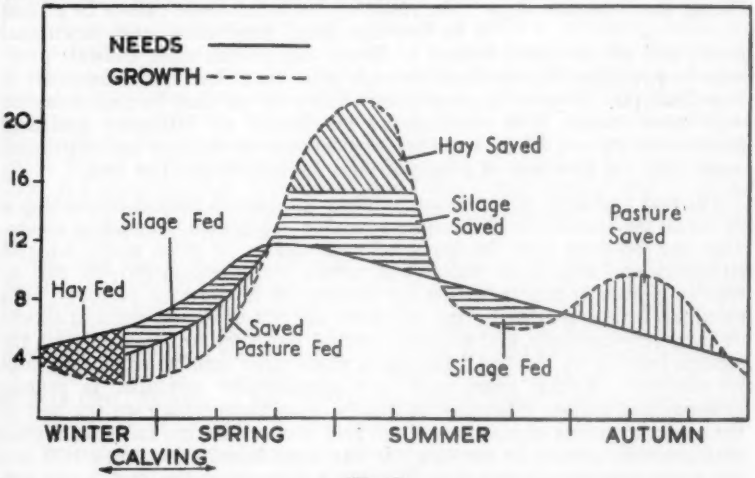

Fig. 2

Pasture Growth and Dairy Herd Needs in New Zealand

(After McMeekan)

Here the rate of stocking is 60 cows to 100 acres. This means that there will be surplus grass at the peaks of growth, and all of this is conserved in one of three forms—hay, silage or saved pasture. The best pastures are always retained for the milking cows, but all grazing is controlled with the object of avoiding waste, and dry stock are used to clean up pastures. Hay is generally fed to dry cows in winter and saved pasture and silage are fed to supplement spring pasture as the cows calve.

The fit between grass production and utilization in this case is not nearly so good as in fat lamb production, but grass production is high and there is

a minimum of waste on the best farms. Because of the increased amount of conservation, some waste is inevitable. It is interesting to note that, compared with the fat lamb farm, the dairy farm adopts rotation grazing, as opposed to set stocking, and it has been found experimentally at Ruakura that by far the best system of calf rearing in New Zealand is to graze calves rotationally in front of the dairy cows. These two systems based on relatively efficient utilization of grass produce lamb and butter at lower costs than those of any other country in the world.

The New Zealand fat lamb and dairy farms are good illustrations of the fact that the closer the fit between seasonal grass production and nutritional needs of the livestock the more efficient will be the utilization of the grass. As divergence between seasonal grass production and nutritional needs increases, then the problems of grass production and utilization also increase.

In New Zealand the grazing season is a relatively long one. Maximum nutritional needs coincide with maximum grass production and the principal livestock products are marketed in manufactured or frozen forms. In Britain, on the other hand, the grazing season is, on the average, relatively short and there is a much greater spread of nutritional needs, because the majority of the livestock products are required in a fresh state all the year round.

Filling the Seasonal Gaps The result of this is that there cannot be a close fit between grass production and nutritional needs, and the grassland farmer in Britain has to face more difficult problems in providing for his stock through grass than does his counterpart in New Zealand. In general, grass in its various forms must be supplemented with other foods. The challenge of the British or European grassland farmer is to try and fill the seasonal gaps between production and nutritional needs with the least loss of grass nutrients consistent with low cost.

The first and most obvious step in filling the gaps in natural production is to use all the appropriate techniques available to lengthen the grazing season. This can be done both by using selected strains of grass under suitable environmental conditions which will permit out-of-season growth, and by reserving grass grown in season for grazing off in dormant periods. It is essential, of course, that having provided this out-of-season grass, it should be used very carefully, and rationed grazing, either by strip grazing with the electric fence or by rotational grazing or some other suitable technique, must be adopted. Recent years have seen considerable advances in grazing methods and grazing efficiency, but under most conditions even the best of the modern systems of grazing will not give good utilization unless combined with periodic cutting or mowing. It has been found at Jealott's Hill and elsewhere that by continuing strip grazing throughout the season the percentage utilization decreases with each grazing, whereas when one or more of the grass crops are removed by cutting utilization is very much better.

However successful the British farmer may be in extending the grazing season, it is unlikely under most conditions that he will be able to provide adequately for his stock on an all-the-year-round basis from grazing alone, and unless he is prepared to run the risk of being greatly overstocked during lean periods, he is certain to have a surplus of grass at the periods of maximum growth in May-June and again in the autumn. These circumstances have led to the traditional techniques of grass conservation in which grass surplus to grazing needs at the peak periods of growth is conserved in one form or another for feeding at other periods, mainly in winter.

Make More Silage The systems of grass conservation mainly practised in Britain, and indeed in most countries, are the making of hay, silage and dried grass. So much has been written on these subjects that any remarks from me would almost certainly be needless repetition, but grass conservation plays such an important part in efficient utilization of grass under British conditions that some discussion of the merits and demerits of the various techniques is essential in a paper on grass utilization.

Whatever form of grass conservation is used, there is loss of feed nutrients in the process, and it is as well to remind ourselves of the order of these losses by reference to the following table.

Losses in Nutritive Value in Various Methods of Grass Conservation

(After Watson, 1939)

Product	Starch Equivalent	Digestible Crude Protein
	per cent	*per cent*
Artificially dried grass	5.0	7.5
Silage with acid or molasses ...	22.5	10.0
Silage without additions	35.0	40.0
Hay made on tripod, etc.	40.0	25.0
Hay made on the ground	45.0	32.5

With the exception of artificially dried grass, all conserved products show considerable losses, even when made under reasonably good conditions.

With increasing labour and fuel costs, dried grass is becoming relatively expensive to make and its place on the farm must, therefore, be dictated by economic considerations. Where high quality dried grass can be made and fed at a lower cost than equivalent nutrients in cereals and purchased concentrates, it is obviously a good proposition, but in order to provide sufficient flexibility to deal with peaks in production it is usually better to combine grass drying with silage-making. In spite of the high loss of nutrients in hay- and silage-making, it is clear from Table 2 that average hay or silage will provide starch equivalent at a lower cost than any other product, except grazed pasture or perhaps kale.

Hay and silage account for over 95 per cent of all grass conserved in Britain, and of this fraction 90 per cent is still in the form of hay—mostly hay made on the ground. Good hay is an excellent feed and some good hay is essential on almost all stock farms, but haymaking on the scale at present practised in Britain is one of the main reasons for our low general efficiency in grass utilization. I adhere to this view in spite of the fact that at the present time, because of the exceptional season, there must be more good hay on British farms than for years past.

Climatically, our conditions on the average are not compatible with the making of 6 million tons of hay annually (just over 5 million tons of dry matter), and in order to increase our efficiency of grass utilization economically and reduce the cost of producing livestock products, we should be making much less hay and much more silage. Apart from silage-making being a better form of conservation under our conditions, it is much more compatible with good pasture management than haymaking. As has been mentioned already, the use of the mower is essential to ensure efficient grazing, and the taking of grass cuts for silage fits in extremely well with either rotational or strip grazing—the most efficient forms of grazing.

Silage-making plays a much less important part in Britain than in most other countries with advanced systems of agriculture, yet our need to make the fullest use of silage is greater than most. In Britain we should be con-

serving more grass nutrients in the form of silage than as hay. This means that we should be making 15 million tons of silage at least (3 million tons of dry matter), and not 2½ million tons as at present (½ million tons of dry matter). If we are to reach this level of silage production in a reasonable time, then much more progress on silage-making will be required than has been achieved in recent years.

Undoubtedly many problems remain to be solved before silage-making can be considered fully efficient. Better quality silage than that normally made is essential. It must be better protected from the weather and handling and feeding must be more fully mechanized and simplified. Much more experimental work must be devoted to these ends. If, however, the view is correct that six times the present tonnage of silage is essential for efficient grass utilization in Britain, then there must be a new approach to the whole question of silage-making.

Various methods have been used over the past fifteen years to encourage increased silage-making in Britain, but none has so far been particularly successful. At a time when substantial financial support is being applied to British agriculture, mostly in the form of deficiency payments for products, the question arises as to whether a better return might be obtained by applying some of this in the form of direct financial assistance to silage-making. A widespread adoption of silage-making on dairy- and stock-raising farms in Britain, with all that this implies in better grass utilization, would probably go further towards reducing the cost of production of some of our most important livestock products than any other single step which could be taken.

Some Outstanding Problems I have given this emphasis to silage-making because I believe that unless very much greater progress is achieved in this field, efficient grass utilization in Britain will be greatly impeded. This does not mean, however, that all the problems associated with the utilization of grass by the grazing animal have been solved, although, as has been said, considerable progress has been made in grazing techniques in recent years. In all grassland countries, and in such progressive grassland countries as New Zealand and Holland, various important problems still exist in relation to the efficient utilization of grass by grazing. Of these the most important are probably those associated with animal health, and a stage has now been reached where solutions to such problems as hypomagnesaemia, bloat, infertility, various allergies, parasitism, etc., must be found if further advances in achieving higher output from grassland are not to be delayed.

Another problem which often confronts the grassland farmer is the apparent lower nutritional value of pasture in autumn compared with spring pasture, even though the autumn pasture may be found by chemical analysis to be as high in nutrients, on a dry matter basis, as the spring pasture. Unfortunately, there is only a small amount of experimental evidence on this point and much of this is inconclusive. On the one hand, it has been shown that autumn grass has a lower sugar content than spring grass and also lower digestibility, whereas against this Holmes at the Hannah Dairy Research Institute and Dijkstra in Holland found no difference in milk yields between cows fed on spring and autumn dried grass. It is possible that the cold autumn weather increases the energy requirements of the grazing animal and the higher moisture content associated with autumn grass is likely to decrease the intake of dry matter, and it may be that soiling and parasitic infestation at this time of the year lower the efficiency of utilization. Clearly, more research on the subject is needed.

It is obvious from what I have said that to make the best use of our pastures much more information is required on all aspects of the problem of grass utilization. Furthermore, the economic importance of grass in Britain, and indeed the world, warrants much greater attention to these problems than has been given hitherto. It is, however, an undisputed fact that if our present knowledge relating to the production and use of grass were fully exploited, output from British farms could be increased substantially and at relatively low cost. It is unlikely that great progress will be made in lowering the cost of producing animal products in Britain until grass is providing a very much larger proportion of the feed of our ruminant livestock. Efficient grass utilization is the means to this end.

TRICKLE IRRIGATION AND WATER REQUIREMENT

G. F. SHEARD, M.Sc.

Director, Fairfield Experimental Horticulture Station, Kirkham, Lancs

Trickle irrigation of glasshouse crops is commanding more and more attention. The three main factors, upon which success depends, are the soil, the water supply, and the equipment.

WATER and nutrients are essential for the development and maturing of glasshouse crops. In the constant search for methods of improving quality and yield and reducing the cost of production, trickle irrigation and the application of nutrients in solution are being used increasingly. Most experience has been gained with the tomato, but the basic principles can be applied to most glasshouse crops.

Water is taken up from the soil by plant roots and translocated through the water-conducting tissues to the aerial parts. A small amount of water is used in the various growth processes producing stem, leaf and fruit and as an essential component of plant tissue, but most of the water taken up by the roots is lost in the process of transpiration. A plant transpires in order to keep itself cool, for when solar radiation falls on a leaf the energy is absorbed, causing a rise in temperature. To keep this rise within safe limits and prevent the tissues being killed, the heat energy is dissipated in the evaporation of water by transpiration. Thus the water requirement of a crop varies with the weather conditions: the brighter and longer the day, the larger; the duller and shorter the day, the smaller it will be. In support of this, a very good correlation has been found between the amount of solar radiation entering a glasshouse and the water requirement of a tomato crop in the glasshouse ([1]). From readings taken at Fairfield, which is in the Fylde area of Lancashire, the daily water requirement in the period May-August can vary from 600 gallons per acre on a dull day to 5,000 gallons per acre on a very bright, sunny day. Roughly, this means a range of ½ pint to 4 pints per plant per day. The total amount of water needed during the growing season varies little from year to year, and for maincrop tomatoes amounts to 22-25 gallons per plant.

TRICKLE IRRIGATION AND WATER REQUIREMENT

In the past, water has been applied to the soil surface by hose-pipe and allowed to drain to the lower layers. The frequency of application has, at most, been twice weekly and often, in the height of the season, only once a week. At each major watering the borders are flooded and the excess allowed to drain away, leaving the border saturated, or at "field capacity". As the crop removes water from the soil, the moisture content gradually decreases until the next application, when the soil is returned to a point near field capacity. Any particular soil can hold only a fixed amount of freely available water, and the greater the interval between waterings, the greater is the risk of this reserve being depleted and the crop suffering from lack of water. The work of Salter at Nottingham University ([2]) has suggested that the highest yields of tomatoes are obtained when the soil is maintained at a constant high moisture level. Variations in the moisture regime in the soil and growing under low moisture regimes are likely to give lower yields.

The watering of glasshouse crops, particularly tomatoes, calls for a good deal of labour in the period May-August. Other cultural operations such as side-shooting, twisting, leafing and picking also make heavy demands at this time. It is difficult to assign priorities to work; inevitably, at the height of the season some operation has to be neglected which may adversely affect the quality and yield of the crop.

Uniform Application and Uniform Spread So as to maintain a high uniform content of moisture and cut down the cost of, and ease the demand for, labour in watering, an increasing interest is being shown in methods of applying water to the borders automatically. Several systems are in different stages of development, and these can be grouped conveniently as follows:

1. Systems using ground pipes fitted at intervals with diffuser-type nozzles dispersing the water over the soil surface at a relatively high rate.
2. Systems using ground pipes drilled with small diameter holes from which the water issues in a fine jet. Dispersion over an area is given either by a pattern of holes giving different trajectories or by a cyclical variation in the head of water in the pipes varying the carry of the jet. The rate of application is relatively high.
3. Systems using some form of drip nozzle buttoned into a harness of rubber lines distributed over the border area. The rate of application is low.

At present it is difficult to assess which system will be most generally useful, but it is probable that each will have its place under particular conditions. Systems 1 and 2 are not yet available commercially in this country, and system 3, the "trickle" system, is the only one of which we have any large-scale experience.

For success, a trickle irrigation system should give a uniform application of water from all sections of the harness and a uniform spread of water through the soil from each nozzle. Three factors are involved for success: the soil, the water supply, and the equipment.

Not all soils give a satisfactory spread of water from a drip nozzle. On light, sandy or gravelly soils with very free drainage, the water tends to drain in a narrow cylindrical column, there is little lateral spread and a large volume of soil between the nozzles gradually dries out and is not rewetted. On such soils trickle irrigation will not be successful, and it is a wise precaution to test a soil with a small harness before a large area is put down to the system. On a suitable soil the surface area in the vicinity of the nozzle is moist but the remainder of the soil surface remains dry. If a section of the border is taken midway between two nozzles the top 2-2½ inches will be dry, but below this the soil should be uniformly moist. This surface dryness is an advantage: the humidity around the base of the plant is kept lower,

bottom trusses remain clean and less trouble is experienced with fungi causing foot rot of the stem and fruit rots such as "buck-eye". On difficult soils, distribution can be improved by increasing the number of nozzles, but this entails increased capital cost, and with tomatoes no more than one nozzle per plant is warranted.

The quality of the water supply can also effect the efficiency of the system. A good mains supply is to be preferred wherever possible. River water and some well waters can give trouble if they contain suspended solid material. It is essential to have good filters, but even where these are efficient suspended matter may get through and settle in the lines and nozzles, so impeding the flow and causing nozzle blockage. With waters containing large amounts of dissolved calcium or magnesium, soluble phosphate applied in the liquid feed will be precipitated as insoluble calcium or magnesium phosphate. This also may settle in the lines and nozzles. In districts with very hard water, nozzles tend to become encrusted, and over a period the incrustation may build up and eventually cause blockage.

The equipment should be so designed that, within reasonable limits, each nozzle gives the same delivery. The rate of drip of a nozzle will vary with the head of water on the system; the higher the rate of drip, the less easily will nozzles block. Limitations are, however, set on the rate of drip by the design of the system in order to get uniformity of distribution. In most systems, the delivery rate is between 2 and 4 pints per nozzle per hour. Some systems work directly off the mains, the head being set by adjusting the stop valve to give the required reading on a small pressure gauge or the correct height in a sight glass. Other systems work indirectly through an elevated tank, the water level in which is maintained by a ball valve. The latter has the advantage of maintaining a constant head independent of changes in the mains pressure. The direct systems tend to have variable heads and therefore variable deliveries, so giving variations in mains water pressure.

The materials from which the harness is made are important. P.V.C. plastic tubing and fittings encourage bacterial growth, which accumulates as a jelly and causes nozzle blockage. Rubber and polythene do not give this trouble and are to be preferred. Where rubber is used, it should be of a quality which will have a good life when exposed to sunlight and under the general conditions obtaining in glasshouses. It is inevitable that some nozzle blockage will occur even in the best systems, so nozzle design is important. Nozzles which are easily and quickly taken apart for cleaning are preferable to those more difficult to clean, if their performance is otherwise equal.

Daily Practice In using trickle irrigation, it is best to apply water daily: less frequently than this gives a greater variation in the water content of the soil. At present there is no convenient instrument available to the grower for measuring the water requirement of a glasshouse crop, though it is likely that suitable instruments will be developed in the not too distant future. A grower can use the figures of water requirement given earlier and interpolate between the extremes along the following lines:

Weather	Water Requirement per Day	
	gallons per acre	*pints per plant*
Very dull	600	½
Dull	1,000	1
Moderately bright	2,500	2
Bright	3,500	3
Very bright	5,000	4

A check can be obtained on whether the correct regime is being maintained by the use of porous, pot-type soil tensiometers. These instruments are available in a form suitable for glasshouse use and cost about £5 each. A minimum of three tensiometers is required to give a reliable guide, and these should be inserted at random over a representative area of the glasshouses, each being positioned midway between two nozzles with the centre of the porous pot 6 inches below soil level. The dial on each instrument is graduated in equal divisions marked 0-60. A low reading indicates that the soil is wet, and high reading dry. For tomatoes, the reading should be maintained as far as possible in the range 7-10. When readings higher than 10 are indicated, the empirical figures of water application given above should be adjusted to bring the range back to 7-10. These instruments cannot be used by the grower to measure the water requirement of a crop.

The amount of water applied can be measured by fitting a small water meter in the supply main, by measuring the delivery from a pilot nozzle, or by assuming a fixed rate of delivery for a particular type of nozzle and working on a time basis. Suitable water meters cost £5-7 and are the most satisfactory method of measurement, though the delivery from a pilot nozzle is accurate enough for most purposes. The third method, working on an assumed delivery and time basis, is liable to error and is not recommended.

Next month Mr. Sheard will discuss the subject of liquid feeding.

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PERMANENT COVER CROPS FOR BLACK CURRANTS AND RASPBERRIES

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Contrary to normal practice, some Herefordshire fruit growers have been growing black currants and raspberries under permanent grass cover crops. Neither growth nor yields appear to have suffered, and the method has much to commend it from the point of view of management.

CLEAN cultivation has gone hand in hand with bush and cane fruit growing for a very long time, and writers, old and modern alike, have never deviated from preaching the need for shallow cultivation and weed-free conditions for soft fruits. In the face of this, advocacy of the use of permanent cover crops for bush fruits may well sound like heresy. Yet there are many advantages to be gained from this method, which has already been tried by some growers. The following account is based upon the experiences of four fruit growers in Herefordshire who have now been growing black currants and raspberries with cover crops for up to five years.

Before going into details of methods and results, it would perhaps be as well to describe the growing conditions in the area. Herefordshire is often looked upon as being in the moist (if not wet) west, but the average rainfall of all the fruit farms concerned in this article is 27 inches. Probably evaporation of moisture is not as great as in the east and the hours of sunlight may generally be slightly less. The soils vary from the light sands of the Ross series of the Old Red Sandstone to the heavier glacial drifts of the area around the city of Hereford.

The first reason for using a cover crop may well be that of convenience. For example, a cover crop of grass, with or without clover, provides a much more convenient passage for spraying equipment and workers, especially pickers, than does a cultivated strip. A cover crop, once established, is also easier to manage than cultivated soil, since less judgment is required in deciding when and how to mow the cover crop than in planning ploughing and cultivation. Another point, especially on the lighter Ross soils, is the lessening or prevention of soil erosion, which can be a serious problem on sloping fields. Damage to roots by cultivating implements is also obviated.

In the field of nutrition, potash and iron should be more readily available to the plant and a saving in potash might be made; nitrogen should be available over a longer period and less would be lost by leaching than under clean cultivation. After picking, the amount of work needed to prepare the land for winter would be less; usually only one, or at the most two, mowings should suffice.

There are also a few obvious objections. First, the soil immediately under the bushes needs special treatment. If the bushes are vigorous it may well be that no weeds or cover crop will grow for a foot or so on either side of the row of bushes, but this has not been the experience in Herefordshire. There, weeds, clovers and grasses tend to grow up into bushes and get in the way of pickers. This tall growth must take appreciably more water out of the soil than if it were cut short. To remedy it, a heavy straw mulch (or

other similar material) should be applied one foot on either side of the bushes. The first application will take about 6 tons per acre and it will need topping up year by year, usually at the rate of 2-3 tons per acre. But even though this mulch will eliminate most weeds, some, like bindweed, thistles, docks, and even couch, will grow through it. The obvious solution —starting with clean land—is not always possible and hand weeding of thistles and docks may therefore be necessary.

The grass will have to be cut frequently from April (sometimes March) up to picking time, and again after picking. But although the number of operations will exceed the cultivations needed on arable land, a rotary grass cutter may be pulled at a faster speed than a cultivator or spring-tined harrow. In cultivated black currants many fruit growers have taken to using a rotary cultivator driven from a power-take-off and pulled by a tractor; this does away with the tedious task of collecting and disposing of prunings, which can be cultivated in quite successfully. With a cover crop, prunings must be removed, though even this can be mechanized to some extent by the adaptation of a hay sweep or by making a special sweep for the job.

Another aspect to be considered in weighing the advantages or disadvantages of cover crops is that of diseases and pests. There seems to be no reason why diseases or insect pests should thrive more under one system than under the other, but it has been observed that the Red Spider mite of black currants appears earlier in the season from its hibernating quarters below the bushes where the soil is strawed down.

Selecting the Cover Little is known about the best type of cover crop to use. Indeed, so sparse is the information available that it was decided in 1953 to sow down a plantation of black currants in Herefordshire with a number of different grasses, both with and without clover, to provide some guidance. The grasses used included *Agrostis tenuis* (brown top), S.59 red fescue, S.50 timothy, and S.23 ryegrass. As a result of these trials, a little more is now known of what is desirable in a cover crop. First, we do not want a vigorous grass which will compete unduly with the black currants for water and nutrients. Secondly, it should stand up well to the passage of implements (and in this respect it is as well to remember that the width of black currant rows leaves no room for varying the wheel tracks of the tractor). Finally, we want it to cover the ground right up to the straw mulch. In our trials it was noticeable that some grasses did much better than others in this respect. S.23 ryegrass is not very good, but S.50 timothy, S.59 red fescue and *Agrostis tenuis* creep out and cover the soil right up to the straw. Whether clover is needed or could be used alone with advantage is yet to be ascertained. Certainly, however, in all the grassing down or cover crop trials in Herefordshire where clover has not been sown and is absent from the sward, the plots can be picked out by the paleness of the grass throughout the entire season. Does this mean that where clover is included there is more nitrogen available to produce the dark green colour?

For cutting the cover crop, a three-bladed rotary grass cutter has been used. It has the advantage that, by arranging the direction of turn of the blades, the cut grass is flung away from the machine on either side and a large amount of the material falls on the straw at the base of the bushes and so adds humus where it can be most useful. Gang mowers have not been used much in black currants here, but they have proved most successful for a number of years in a raspberry plantation.

Experience from Four Plots Much of the information already given has been acquired from the experience of watching four plots in Herefordshire. The first plot comprised black currants, variety Seabrook's Black. The 3¾ acres were planted in 1943 but were subsequently allowed to "tumble down", or become a self-seeded plot, in 1949. Since that time, the alleys have been mown regularly with a rotary cutter. The rows of bushes have been strawed and mulched regularly with the grass cut from the alleys. No control plots were left, so there is no direct comparison between cultivated and cover crops, but the crops have not been less than when the black currants were cultivated. The following yields were recorded for the four years 1951-54:

	tons per acre
1951	1.7
1952	2.7
1953	1.7
1954	1.2

Plot 2, consisting of black currants, variety Mendip Cross, was sown down with S.100 white clover in 1950. A complete cover of clover was required and no mulching of the rows was attempted. The soil was a light sand overlying sandstone rock at between 18 and 36 inches deep (deep Ross series, Old Red Sandstone). This soil is very susceptible to drought and, because of a slope, erosion is a problem. For the first three years there was no apparent difference in crop or growth between the rows of bushes sown down with clover and those clean cultivated. In the fourth year the growth of black currants under clover appeared to be slightly less than those clean cultivated, but since irrigation has been extended to this plot it appears that growth is once more equal on cultivated and cover crop plots.

The soil on Plot 3 (black currants, variety Baldwin Hilltop) varies between the heavy and light phases of the Old Red Sandstone. The depth varies, with an average of 18-24 inches, overlying Old Red Sandstone rock or marl. Whilst it can dry out in a dry summer, it is not as subject to drought as Plot 2. Here a trial plot was laid out to test the effects of a number of grasses with and without clover. Sowing took place in April 1953, and during 1953 and 1954 there was no noticeable difference in shoot growth between the bushes in this plot and in a neighbouring cultivated one. On the other hand, the crop was heavier in both 1953 and 1954 on the grass plots. This effect has been observed elsewhere and may well be due to the absence of damage to roots in the first year and the increased root run.

The crop from this plot was 4.24 tons per acre in 1953 and 3.46 tons per acre in 1954. Adjoining this is a cultivated plot, but identical in all other respects, which in the same two years yielded 4.23 and 2.91 tons per acre.

The last plot consisted of raspberries (Malling Promise). Rainfall here averages 26.6 inches (records taken on the farm). The soil is deep, well drained and approximates to the deep medium loam so often recommended. It is a glacial drift which, though mainly of Old Red Sandstone origin, contains a certain amount of limestone particles. The 1¾ acres were planted in 1949-50 and sown down with 5 lb. wild white clover. Since then, the plot has been kept closely mown with a tractor and a gang mower, and subsequently with a narrow rotary cutter. No mulching has been done since sowing, but in the very narrow strip (9 inches) left unmown some weeds have grown, and tall ones such as nettle, dock and cocksfoot have grown up with the new cane, and have had to be cut by hand. Manuring has been generous: 7-8 tons of well-rotted farmyard manure and 6 cwt. of an organic compound, basically meat- and bonemeal, have been applied annually.

Throughout, cane growth has been more than adequate, and the following approximate crop weights have been taken:

	cwt. per acre
1950	5½
1951	53
1952	89
1953	67
1954	50½

Encouraging Results Summing up the results obtained over this short period of observation, only on one plot of very light soil has there been any reduction in the amount of new growth in black currant bushes under grass or clover, and in this instance no strawing or mulching of the row took place, so that the whole area of the soil was covered by the cover crop. In all other trials the first crop after grassing down has been no less than under clean cultivation and in some cases has been more.

With raspberries, only one example can be cited. No mulching of the rows was carried out, and, in any case, it would be a very doubtful proposition with this crop; yet the crop results have been good. In this crop, the cost of cultivation has been very much reduced and picking of the fruit has been made very much easier, particularly as raspberries cannot be cleared in one operation.

The results in Herefordshire so far have encouraged some fruit growers to try the system on an extended scale. It is, of course, much easier to sow a field with grass seeds before planting black currant bushes, and sometimes it might well be that a field intended for black currants is already down to ley. In this case, the task of growing the crop would be lightened if the actual row where the bushes are to be planted is cultivated (possibly by a 22-inch rotary hoe) and the bushes planted in the centre of the cultivation. During the first year the "row" would be kept clean cultivated and the grass strip mown regularly. Strawing down and mulching would be done in the following winter or spring. Whilst I should not like to make any recommendation for this system yet, it will be interesting to see how one field of some 15 acres which has been treated in this way will succeed in the next few years.

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EGG PRODUCTION AND FLASH LIGHTING

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Results of experiments at Nottingham with flash lighting of fold units point to a relatively inexpensive way of increasing egg output on poultry farms not connected to a mains supply of electricity.

IN the last few years several workers have carried out trials to determine the effect of light shock on the laying potential of poultry. These trials have usually been designed to compare flash lighting by 1,500 watt lamps for periods of up to 20 seconds at a time with continuous lighting using 40-75 watt lamps. The results have generally shown some slight advantage in favour of flash lighting. Thus Blount at Stoke Mandeville in 1953, using 1,500 watt lighting and four flashes of 20 seconds each at hourly intervals between 3 and 6 a.m. in comparison with four hours continuous at 75 watts from 10 p.m. to 2 a.m., obtained the following averages over 28 weeks:

Lighting	Eggs per Bird
Flash	116
Continuous	112
None	105

Apart from any increased egg output, however, one of the greatest advantages of flash lighting over continuous lighting is the tremendous saving in current consumption when operated from a mains supply. A further attraction is that where a mains supply is not available, lighting can easily be provided from batteries. Car batteries, which are made to give heavy discharges of short duration (as when starting the engine), are ideal for the purpose. One possible disadvantage is that during the winter months the days are so short that the birds' food intake may be sufficient to support a higher egg production, although the stimulus to lay is present. It should, however, be possible to formulate a method of feeding (say, with pellets) which would overcome this.

At the University of Nottingham School of Agriculture, a flock of 950 layers is maintained in fold units, each holding 25 birds. The experiment described here involved flash lighting six of these folds to decide the intensity of light necessary to give maximum production, and to demonstrate a simple unit which could be fitted and used away from a mains supply of electricity.

Standard Equipment A pilot experiment was tried during the preceding winter of 1953-54 to determine the best means of lighting the folds, using, as far as possible, equipment which could be bought easily. A standard intensity of light was decided to be 300 lumens* per sq. foot, measured at the eye level of the bird when it was resting on the slatted floor of the fold. The most practical lamp was found to be the 25 volt general service lighting lamp, which is available in 40, 60 and 100 watt ratings. Three lamps in each fold, fastened to the roof by batten holders, gave the best illumination, and when white plastic shades were added the illumination was more than doubled on the smaller ratings and almost doubled on the highest wattage. Ordinary car bulbs were tried but they

* A lumen is a measurement of the amount of light emitted from a point in one direction, and is approximately the same as the amount of light given by an ordinary candle.

were expensive and the smaller fittings made them difficult to mount. The batten holders were plastic, and during the experiment proper, both holders and shades had to be replaced due to the hens taking fright and breaking them. What caused the upset and whether or not it was in the lighted period is not known, for the damage was discovered only when the eggs were being collected. All-brass fittings and white enamel shades would have been more satisfactory. The colour of the birds affected the intensity of the light considerably, the white breed giving a greater intensity, particularly when using 100 watt lamps. The average intensity obtained was 275, 410 and 745 lumens per sq. foot for the 40, 60 and 100 watt lamps respectively.

The current supply was obtained from 12 volt, 75 ampere-hour car batteries, wired in series to give 24 volts, and supplied through a condenser delay unit working in conjunction with a clock which was adjusted to switch on the delay unit for 20 seconds at 2 a.m., 3.25 a.m., and 4.50 a.m. These settings were used because it was not possible to set the clock at closer intervals than 85 minutes. All the equipment was mounted on a sledge so that it could be moved easily with the folds by the attendant. A third 12 volt battery was acquired to allow one battery to be changed and charged weekly. The actual discharge every day was 70 amperes for a total time of one minute, so in practice the batteries used could have stood for longer than two weeks without charging and would have taken a far greater load.

One point which had to be watched was the danger of voltage drop over long lengths of cable. The method of wiring finally decided upon was to take a cable from the supply to folds 2 and 5, and further cables from these to supply the folds on either side. Each cable was 16 feet long and was permanently connected at one end only, with a waterproof, 2-pin plug socket at the other. Although the folds were only 5 feet apart, 16 feet of cable was allowed to help the attendant when moving them. In practice, the cables had to be disconnected, and shorter lengths would have served, thus reducing the possible voltage drop. It was necessary to use a very heavy cable to obviate voltage drop, and 70/.0076 twin cable sheathed in flexible tough rubber was recommended by the manufacturers of the lamps. This cable gave a drop of 1.1 volts per 100 feet, and as the maximum cable distance of any lamp from the source of supply was 35 feet, this proved to be of no real account. The precaution was taken of putting the lower voltage lamps in the centres of the wiring circuits (that is, in folds 2 and 5) so that the lamps with the greatest resistance were as close to the batteries as possible.

The electrical equipment worked very satisfactorily throughout the 24 weeks of the trial. The only difficulty encountered was the occasional smashing of a shade, bulb or batten holder by the birds. When the birds were watched during the lighted periods, they took very little notice of the lights, and only occasionally did one move. The usual reaction was a placid staring at the lights.

The six folds used were divided into pairs lighted by 40, 60 and 100 watt bulbs. Each fold was equipped with three lamps. There were not sufficient pullets of one age and hatch to stock the whole group with the same breed, so 75 March-hatched Rhode Island Reds were divided between three folds of varying light intensities and 75 April-hatched White Leghorn × Rhode Island Reds were split among the other three folds. Thus each pair of folds with the same intensity of light had 25 R.I.R. in one fold and 25 W.L. × R.I.R. in the other.

The management and routine of the lighted folds was exactly the same as for the remainder of the poultry unit. All birds received a wet mash feed of a home-mixed layers' mash about 9 a.m. and a grain feed of wheat, barley

and oats about 3.30 p.m. Water, flint grit and cockle shell were supplied *ad lib.* As much wet mash was fed as the birds would eat in 1-1½ hours. The grain feed was a measured 2 oz. per bird. No particular differences were noted by the poultryman in charge between the various folds, and food consumption was not obviously different. Shortage of labour prevented the separate measurement of food consumption in each fold.

Best Results with 60 Watt Lamps The winter of 1954-55 proved a most unfortunate one for folding units. Ours were on a rather low-lying pasture and the prolonged wet weather made conditions very bad. The birds were continually in mud, and after one particularly heavy downpour water remained on top of the turf for some time. To add to the appalling conditions, snow and ice followed, and on one occasion the folds were locked in frozen mud and water for a week before they could be moved on. It is not surprising, therefore, that egg production was generally rather low.

The results, expressed as an average per bird per month, based on the number of hen-days in each 28-day period, are given in Table 1. The averages of the R.I.Rs and W.L. × R.I.Rs in the unlighted folds are also given, but they are not strictly comparable because the R.I.Rs were hatched earlier and the W.L. × R.I.Rs later than the lighted stock. The unlighted units consisted of 7 folds of R.I.R. containing 173 pullets and 3 folds of W.L. × R.I.R. containing 75 pullets.

Table 1
Average Egg Production per Bird (Hen-Day Average) for Varying Intensities of Light

Period	Total Illumination per Fold			
	Unlighted	120 watts	180 watts	300 watts
Oct. 6–Nov. 2 ...	9.95	4.73	7.73	6.38
Nov. 3–Nov. 30 ...	10.69	10.50	13.13	11.46
Dec. 1–Dec. 28 ...	10.99	13.24	14.90	13.48
Dec. 29–Jan. 25 ...	11.62	12.60	13.02	13.16
Jan. 26–Feb. 22 ...	13.05	13.10	13.97	15.61
Feb. 23–Mar. 22 ...	14.81	14.70	15.72	17.71
Total ...	71.11	68.87	78.47	77.80

The response to the lighting of the pullets as a whole, and also of the different breeds, is shown in Table 2.

Table 2
Average Egg Production per Bird (Hen-Day Average) as a Whole and within Breeds

Period	R.I.R. and W.L. × R.I.R. Together		R.I.R.		W.L. × R.I.R.	
	Unlighted	Lighted	Unlighted	Lighted	Unlighted	Lighted
Oct. 6–Nov. 2 ...	9.95	6.28	13.72	6.34	1.24	6.23
Nov. 3–Nov. 30 ...	10.69	11.69	10.42	10.51	7.12	12.99
Dec. 1–Dec. 28 ...	10.99	13.87	11.02	13.00	10.93	14.70
Dec. 29–Jan. 25 ...	11.62	12.92	11.02	11.52	12.99	14.29
Jan. 26–Feb. 22 ...	13.05	14.17	12.54	12.18	14.25	16.12
Feb. 23–Mar. 22 ...	14.81	15.97	13.46	14.44	18.02	17.46
Total ...	71.11	74.90	72.18	67.99	64.55	81.79

The unlighted R.I.Rs were the only stock in production at the start of the trial. There appears to be no doubt that the lighting brought the lighter-coloured breed cross into production much quicker than their unlighted sisters and it had the effect of keeping the production up; but the reaction of the R.I.R. pullets to the lights was disappointing. It is probable that the response would have been much better if the lights had been started a month earlier, for with continuous lighting a better performance is obtained when lights are introduced in late August or early September.

It would appear from these results that there is no point in using an intensity of light greater than 440 lumens per sq. foot, as produced by the 60 watt lamps in the folds of the light cross-breds, for there was little difference in the results from this intensity and that provided by the 100 watt lamps; but a lower intensity may be insufficient. These results can only indicate a trend. Under more congenial conditions better results might have been obtained, and the experiment does suggest that there is no advantage in providing lights unless the environment is sufficiently good to encourage maximum production.

It is likely that further work on these lines using a longer period of light than 20 seconds or more than three periods would produce better results.

The writer would like to acknowledge the valuable assistance of Mr. R. B. Shaw, Head of the Poultry Department of the Nottingham School of Agriculture, without whose co-operation the trial could not have taken place.

DAIRYING IN INDIA AND PAKISTAN

A. W. MARSDEN, M.Sc., D.I.C., A.R.C.S., F.R.I.C.

Director, Commonwealth Bureau of Dairy Science, Shinfield, Reading, Berks

About a year ago Mr. Marsden began a tour of dairying centres in several Commonwealth countries extending over many months. During this period he spent some weeks in India and Pakistan, and here gives his impressions of milk production in those countries.

THE Indian Independence Act of 1947 provided for the partition of the sub-continent and the creation of the two independent sovereign states of India and Pakistan within the Commonwealth. These two countries cover a vast area of land with all types of topography and climate, most of it being tropical with summer monsoon rains. In the 1½ million square miles (nearly 28 times bigger than England and Wales) there were over 430 million people at the 1951 census; and present estimates give the population as about 475 millions. Almost one-fifth of the land and people are in Pakistan.

India is primarily an agricultural country, with over 80 per cent of her people living on the land. Millet, rice, maize, wheat, barley, pulses, tea, sugar cane, cotton, jute, groundnuts, linseed, coffee, tobacco and rubber are all important crops. Her national cattle population is the largest in the world, the latest estimates being 155 million zebu cattle (41 million being in milk), 43 million buffaloes (20 million in milk), and many millions of sheep and goats.

Pakistan is also essentially an agricultural country and grows large quantities of rice, wheat, millet, sugar cane, maize, cotton, jute (the world's largest producer), and many other crops. There are 25 million cattle and 5 million buffaloes, besides many millions of sheep, goats and poultry, as in India.

As the human population has increased in each country, so the number of farm holdings has mounted also, but little more land has been cultivated, with the result that the average size of each holding has become smaller. In Bengal, which is very thickly populated, over half the holdings are less than 2 acres and only a quarter are over 5 acres. In other parts the holdings are not much larger, and probably nowhere do they average more than 10-15 acres. On these small areas the peasants and their families raise their crops and feed their stock. To do this, the peasant farmer has to maintain a pair of bullocks for cultivating the land and transporting his produce to market. The position is further complicated since the land is often fragmented and what common or forest grazing there is may be some distance away. Nevertheless, each village farmer tends to operate as a separate unit and does not share his bullocks with his neighbours. Under these conditions mechanized farming is scarcely possible and, except in a few urban areas, cows are kept primarily to produce draft animals.

Many Breeds of Cattle and Buffaloes Throughout the Indian sub-continent there are a large number of breeds of cattle, some fairly widely spread and others found only in certain restricted areas. Some of these breeds appear to be closely related, but it is obvious that many are quite distinct and come from different stock. All the cows are zebu, or humped, cattle and about thirty breeds of draft or dairy type are recognized. In addition, there are some eight breeds of buffaloes which, in spite of their smaller numbers, are more important than the zebu cows as regards the volume of milk they produce. The main dairy breeds of zebu cattle, their native district, type and average annual milk yield when kept under *good* conditions with *good* management, are given in the table below.

Dairy Breeds of Zebu Cattle

Name of Breed	Native District	Weight of Bull	Weight of Cow	Colour.	Milk Yield
		lb.	*lb.*		*gal.*
Gir	Kathiawar	1,200	850	White with red patches	350
Hariana	Punjab and Delhi	1,000	780	White-grey, black points	325
Kankrej	Gujerat	1,350	925	Grey	300
Ongole	Madras	1,300	950	White	300
Red Sindhi	Sind	1,000	700	Red	400
Sahiwal	Punjab	1,200	900	Reddish-dun	500
Tharparker	Sind	1,200	850	Pale grey	350

It should be noted, however, that the *average* milk yield for all the milking cows in India is far less than these figures, being probably only 40-45 gallons a year. The reason for this is that most animals are underfed and many are suffering from some kind of disease. In addition, many cows are very old and past the most productive period of their life. As the cow is a sacred animal to the Hindu, it is against his principles to slaughter old and unproductive animals. In Pakistan the *average* yield is considerably higher, being about 150 gallons a year, but the Pakistani, being a Muslim, is a meat-eater and has no prejudices against cattle slaughter.

In both Pakistan and India, more milk is produced by buffaloes than by zebu cows, in spite of the fact that there are fewer buffaloes than cows. This

is particularly true of the north and west of these two countries. The popularity of the buffalo over the zebu cow as a milk producer is due to many factors, such as her ability to produce more milk of a higher butterfat content, her resistance to disease, her greater ability to convert coarse fodder into milk, and her hardiness under poor management. Furthermore, the buffalo is not a sacred animal (in India) and therefore a certain amount of culling is possible.

The best known buffalo breeds are the Murrah, Nili, Ravi and Surti. All are black or dark brown, thick-bodied animals, with a smooth polished skin. Under reasonably *good* management, buffaloes give about 400 gallons of milk a year. The females weigh 1,000-1,600 lb. and the bulls 1,200-2,500 lb., according to breed. The bullocks are heavy and slow, and for this reason are not favoured as much as zebu bullocks for draft purposes.

Contrasts in Management It does not need an expert to see that the average quality of the cattle in India is poor, and not very much better in Pakistan. The cows are characterized by late maturity and seldom calve down until they are 3 or 4 years old. Their growth is usually stunted and slow, they give poor milk yields and often have long dry periods of anything from 18 months to 2 years. Housing and management are not good and frequently very inadequate. It is stated that there is only one veterinary surgeon for about 100,000 head of cattle, so that sick animals (and there are many) can seldom receive expert attention. The calves are reared very indifferently, with the result that they do not grow into good stock, even if they do possess inherent qualities as good milkers.

Cows and she-buffaloes are kept under a variety of systems, the majority being in or near the villages where the peasant farmers live. Here they are in ones and twos and can be seen roaming about the village or nearby rough or waste ground. Some are taken to so-called grazing areas within reasonable reach of the village, but the amount of feed thus obtained is small, except after the monsoon rains.

In towns and large cities, dairy animals are kept in cow stables or town dairies. Here the animals are milked until they are no longer profitable and then, as a rule, disposed of or returned to the country. In most cases these cattle are kept under very unhygienic conditions and the quality of the milk produced leaves much to be desired. The calves born to cows and buffaloes in the town dairies are often not wanted and are just allowed to die by being deprived of milk from their dams. In cities like Bombay, carts can be seen in the early morning collecting scores of dead calves from the urban cow stables.

In contrast to these conditions, there are a few centres where dairy animals are well housed, managed and fed. Examples are the Aarey Milk Colony outside Bombay, where some 15,000 buffaloes are housed, about 500 in a unit, and the Haringhata Cattle Centre outside Calcutta, where thousands of Hariana cows are kept. These colonies have been started to remove the cattle from the town dairies and to improve the quality of milk produced. Other progressive places are the various military dairy farms, originally started many years ago under the British Indian Army, where large herds of cows and buffaloes were kept to produce milk for the troops. A good example of these farms today is that at Okara in the West Punjab, Pakistan, which is well and efficiently managed. At these big centres the quality of the cattle and their yield of milk are much above average. I saw fine animals at such centres, a few giving up to or over 1,000 gallons in a lactation. The calves are well cared for and reach maturity earlier than the villagers' cattle. Furthermore, the dry period has been cut to a very few months and the

productive life of the animal thereby considerably lengthened. Bulls are carefully selected and most of these big centres and military dairy farms use both natural mating and artificial insemination.

Only about 5 per cent of the cows and buffaloes are kept in town dairies, the great bulk of the milk being produced in the rural areas; but it is estimated that this amounts to only about 8 gallons per square mile. Owing to seasonal calving, milk is scarce in the hot season (May-July), and even at other times it is difficult to ensure regular supplies because of transport difficulties and lack of organization. Urban milk supplies are generally poor, adulteration is widespread, and quality control measures are meagre and obsolete.

The normal butterfat content of most cows' milk is 4.5 per cent or above, and of buffaloes' milk 6.0-7.5 per cent. The price is high and the consumption low, being only about 5 oz. per head daily as both milk and dairy products. About 40 per cent of the milk is used as such, another 40-45 per cent is made into *ghee* (clarified butter fat used for cooking, etc.), and the remainder into a variety of local dairy products.

Dairy Animals are Underfed Probably the most serious single factor in dairy husbandry in India and Pakistan is the lack of food for the cow and she-buffalo. The vast majority of the animals are underfed and many are suffering from serious malnutrition. This results in poor growth, late maturity, long dry periods and reduced resistance to disease. In a country with a human population the size of India's, the first concern of the farmer is to grow human food—rice, wheat, millet, etc.—and there is little land left for the growing of cattle feeds as such. Some legumes, especially berseem clover, are being grown in a few irrigated tracts such as the West Punjab in Pakistan. The result is that the bullocks and milch animals get straw as the basis of their ration with what legumes or concentrates can be spared, grown specially or (rarely) purchased. Under these circumstances it is often surprising that the animals grow as well as they do and are able to work or produce any milk.

In India it is estimated that the available food supply for cattle is 45 per cent short of the minimum requirements. Cereal straws are notoriously low in nutritive value and virtually no attempts are made to conserve fodder in the growing season for use during the hot and dry months before the rains. In many areas, too, there is insufficient water, especially during the very hot weather (early summer), and what is available is impure and unsafe for cattle in most places.

Where milking animals are well reared, managed and receive rations in accordance with production, several breeds of zebu cattle and buffaloes have shown that they are genetically capable of producing milk yields comparable with those of European cattle in temperate climates. It would seem, therefore, that many breeds of cattle in India and Pakistan have the potentialities of being good milkers if properly fed and managed.

The Key Village Scheme Various schemes to improve the ordinary village cattle and raise their milk yield are being undertaken. One important approach in India is the Key Village scheme, which is based on a definite cattle breeding policy, demonstrations of improved management and feeding, proper marketing of cattle and milk, and the control and prevention of disease. Good bulls are being provided in these Key Villages and inferior bulls removed or castrated. Artificial insemination centres are also being started. Proper housing is being built for the cattle and the conservation of fodder as hay or silage is encouraged. Old

and unproductive animals are being segregated and placed in special camps, called " gosadans ", in forest areas where grazing is not at present utilized. Already some 300 Key Villages have been set up and almost as many more are planned during the next year. About 500 gosadans are also envisaged. By these means it is hoped to improve the bullocks for the peasant farmer and, at the same time, ensure a better milk supply.

What of the Future? To the Western eye the enormous number of cattle seen everywhere in India and Pakistan is surprising, but perhaps even more striking is the generally poor condition of the vast majority of these animals. Yet it has been shown in a few centres that several breeds of zebu cattle and of water buffaloes are capable of giving good yields with a high fat content. The main need is for more feed, since the animals are obviously underfed, and what feed they do get is of poor quality—much of it is only cereal straw. If dairy cattle are to be kept in milk for longer periods, more high quality feed will have to be produced and it will also be necessary to conserve feed as hay or silage for use during the hot, dry periods of the year. There is room here for much experimental work on growing suitable grasses and legumes for the prevailing conditions in different areas.

Along with better feeding—which is the first and most important need—it will be necessary to cull the unproductive cows and to castrate or remove the scrub bulls. The establishment of gosadans in the forest areas may be a useful step in this direction, until the Hindu can agree that useless animals should be slaughtered. At the same time, good bulls must be made available either for natural mating or mating by artificial insemination. It is encouraging, therefore, to know that much is being done in this direction by setting up Key Villages at which good stock and good animal husbandry can be seen and the principles passed on to the peasant farmer.

The collection of milk from the millions of very small producers (some have only a pint or two of milk for sale each day) is a major problem. In some areas producers' co-operatives have been started and this system may well prove to be the best for the greatest number of milk producers. But in large cities the milk colony, in which thousands of animals are housed just to produce milk for the local urban area, seems to be favoured. The system appears to have geographical convenience but to be costly both as regards capital and running costs.

In some centres, in both India and Pakistan, there has been a desire to cross European cattle with the local breeds. Some striking results have been obtained in milk yields by the use of Friesian, Ayrshire or Jersey bulls, but I do not think this is a good method of raising milk yields in the long run. Genetically, many breeds of Indian and Pakistani cattle, as well as buffaloes, are capable of giving milk in quantities comparable with good commercial cattle in Britain, the U.S.A. or New Zealand. The introduction of European blood into local cattle is of no use unless the cattle can first be better fed, better housed and better managed. Furthermore, European cattle, or cross-breds with a preponderance of European blood in them, do not stand up to the tropical climate as well as the local breeds, nor have they the same resistance to disease and parasites.

VISIT TO CORSICA

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Impressions of market gardening on a recent visit to Corsica.

THE island of Corsica, lying about 74 miles off the west coast of Italy and 110 miles south-east of France, is just a little smaller than Wales. It is a very mountainous country, cut into two by a fissure which runs from Solenzara in the south-east to Ostriconi in the north. The north-east portion is composed of sedimentary rocks and the rest largely granite. A dorsal range, with peaks of 8,000 feet or so, runs from north to south, and consists of some of the hardest rock formation on the island.

The villages clinging to the mountainsides, although perhaps only 10 miles apart as the crow flies, can be reached only by zigzag routes; a journey of over 70 miles may easily have to be taken in going from one to another. These mountain villages exist for two reasons: formerly they gave protection against the pirates who used regularly to raid the island, and, secondly, since malaria used to be rampant in the valleys, it was safer to live at higher altitudes. The farm labourer thus has to climb down to the fertile valley in the morning and has a strenuous climb back to his mountain home in the evening.

In the east, communications are easier; the valleys are larger, and one therefore finds a far bigger agricultural acreage developing on this side. The Germans destroyed the railways along the eastern seaboard, so the farmers in that region have now to send their products to the west by lorries up tortuous mountain roads fraught with danger in the summer and very often impassable in the winter. Carrying quantities of hay, for instance, by this method is difficult and expensive, as compared with the pre-war loading on railway trucks.

Fortunately, there is plenty of water in the island, but comparatively few artesian wells have been made. In this, the island differs markedly from Majorca, where the Spaniards are "well-minded". In Corsica, the rivers are torrents in the winter but mere trickles in the summer.

The seaboard is very beautiful indeed and, except from Bastia to Solenzara, the most wonderful silver beaches add their charm to its grandeur. About a quarter of the island is covered with forests consisting of ash, oak, pine, chestnut and olive, but the chief bane of the farmer is what is called the

maquis. This consists of myrtle, lavender, pistacias, arbutus, whin, cistus, box, evergreen oaks, ferns and bramble and sometimes thyme, laurel, junipers, honeysuckle and rosemary. It is this *maquis* which gives the island its fragrance, and Napoleon Bonaparte, who of course was born in Corsica, is said to have remarked: "I could recognize Corsica with my eyes closed, from its perfume." Incidentally, the word "maquis", which was given to the underground movement in France during the war, is derived from Corsica, where, when a bandit is in hiding from the police, he is said to have taken to the *maquis*.

Game abounds on the island and includes deer, wild boars, partridges, woodcocks, quails and pigeons. The farmers are very keen on the Corsican blackbird, which they say feeds on the juniper and myrtle berries and so is exceptionally tasty. There are also wild duck, grebe, teal, and sometimes wild goose. Sea fishing is abundant, especially for red mullet, bream, tunny and sardines. Shooting and fishing may be carried out over almost the whole area at very little expense.

The coast-line is notable for its Genoese watch towers—of which there are ninety and most of them well preserved. They were erected against the Barbary pirates who sailed the Mediterranean in the seventeenth century. Smoke signals from any one of them warned the people living along the coast of an imminent raid.

The average temperature on the littoral is as high as 80°F. in the summer and about 50°F. in the winter. The high mountains are, of course, covered with snow in the winter time, and it is possible to be bathed in sunshine at Ajaccio and then to travel 25-30 miles up the mountain and find oneself in the snow.

Limited Development Very little farmyard manure is used on the island, and almost nothing is known about composting. Some of the better market gardeners are, however, using fair quantities of fertilizers, which are recommended to them by the *Services Agricoles*. The land, however, is crying out for humus, and it is hoped that composting will be taught in the future. Much of the work is done by hand; there is very little mechanization. Most growers try to avoid growing the same crop year after year. A few farmers adopt three-course rotations, which consist of maize, corn, and a temporary ley, but for the most part rotations, as we understand them, are unknown.

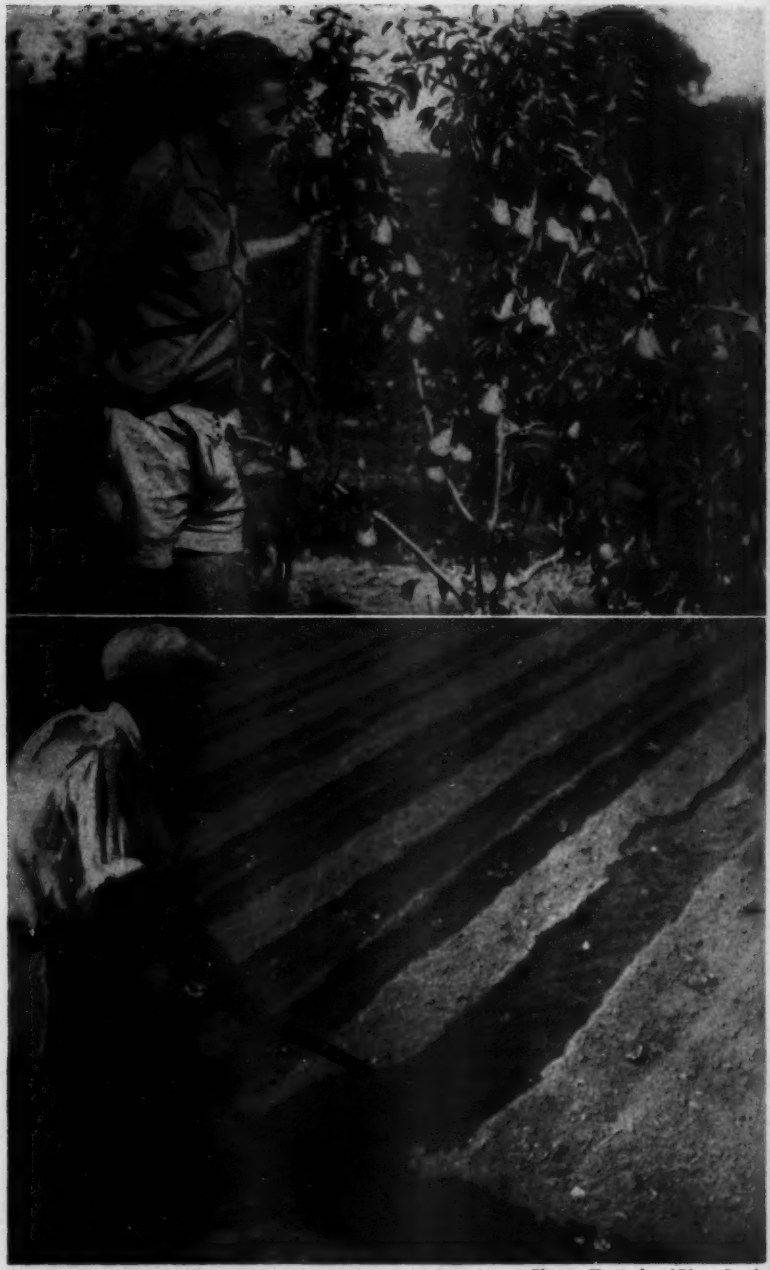
Sheep, goats and the few cattle which I saw graze where their inclination takes them. The result is that the market gardeners and fruit growers have to put up strong fencing against their intrusion. I found enmity between the shepherds and the market gardeners; the shepherds objecting to the market gardeners occupying valuable pasturage and the latter grumbling at the continual ravages of the sheep and goats.

To give a comparison, there are only about 3,000 hectares of market-garden land, 11,000 hectares of orchards and vineyards, 250,000 hectares of pasturage, 210,000 hectares of woods (with olives and chestnuts), and unfortunately 340,000 hectares of agricultural land not cultivated. (A hectare equals roughly 2½ acres.) I estimate that there are still some 50,000 hectares in the Corsican plain completely uncultivated. It is saddening to see vast areas of cultivable land lying idle.

The great needs of Corsica are (a) labour, for the population is only some 268,000, and many are elderly and retired; (b) efficient machinery, which would make the utmost use of the labour available; and (c) good education, for all the young men and women in the country badly need a farm institute

AJACCIO

Photo : *French Govt. Tourist Office*



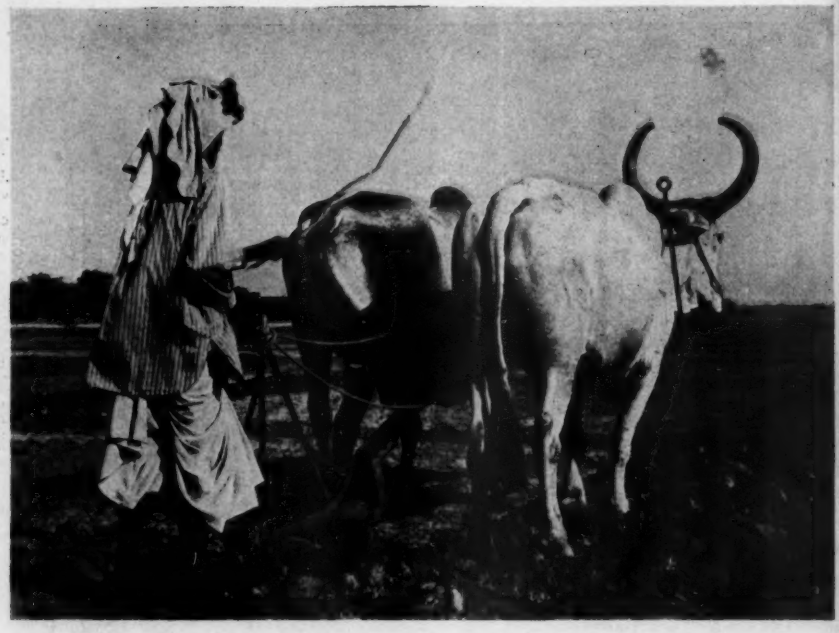
Photos: *Horticultural Photo Supply*

Horticulture in Corsica

A six-year-old Dr. Jules Guyot pear cropping heavily.
Simple irrigation.

Cover Crops for Black Currants (Article on pp. 417-20)

1. The light colour of the grass is due to absence of clover.
2. S.59 red fescue in second season.
3. S.50 timothy and clover.
4. Rotary cutter adapted to cut a 5 ft. 6 in. width.



Primitive ploughing with a pair of bullocks.

Photos: *Indian Government*

A fine Red Sindhi bull at the Government of Mysore dairy farm.

(Article on pp. 424-8)

A good example of a Sahiwal cow, which has given over 3½ gallons of milk a day.

Photos: *Indian Government*

A Nili buffalo with calf. A good milking breed originating from Delhi Province.

Lack of hygiene in town dairies is typified by this example in Calcutta.

Photos: *A. W. Marsden*

Milk producers bring their milk in brass cans to a collecting depot in western India.

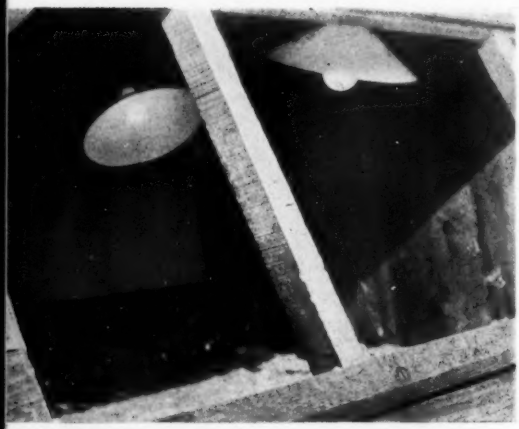
Sheep-Dogs on Trial (Article on pp. 435-8)

Photo: *Berrows' Newspapers Ltd.*

John McDonald and Mirk shedding at Worcester.

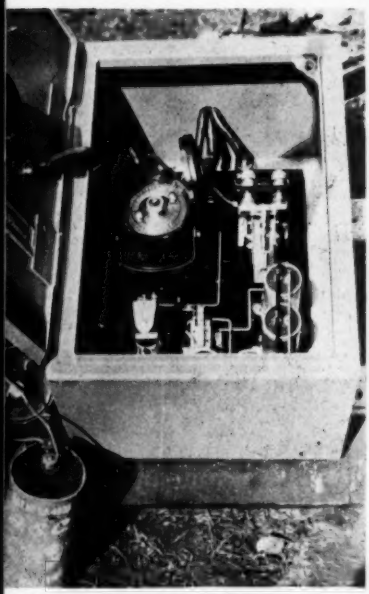
Photo: *Farming News*

Mirk, the 1954 Supreme Champion.

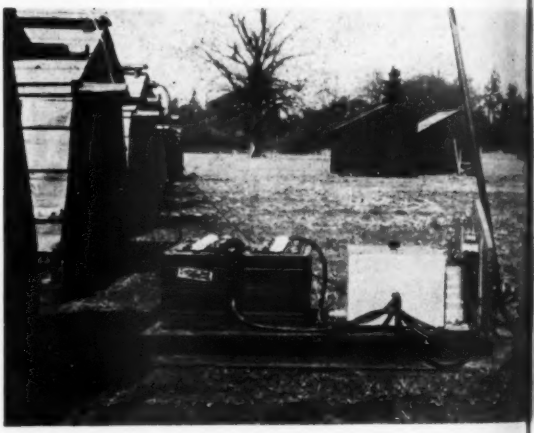


Arrangement of the lamps inside the roosting compartment.

The supply unit mounted on a sledge.



The time clock and condenser delay unit.



General layout of folds and lighting supply unit.

Photos: *E. W. Ni*

where they can be taught how to make better use of the land. Incidentally, the problem of importing labour is the high cost of the "family allowance". Many Sardinians would be glad to come across to Corsica, but their big families would cost the State £40-50 a month each for the children's allowances alone.

Fruit Galore I saw sufficient in the country to realize that it is possible to grow almost all kinds of fruit, and in particular oranges, lemons, grapefruit, apples, pears, plums, peaches and nectarines. Some of the best apples were Red Astrachan, Golden Delicious, Red Delicious, Reinette du Canada, and Reine des Reinettes. The best pears appeared to be Williams's, Dr. Jules Guyot, and Beurre Giffard. The trees are grown on what may be called the "rough espalier" system; that is to say, posts and wires are put down the rows about 4 feet high and the branches roughly tied in. Mulching is carried out with old hay down the rows for the first few years, and later on green manures are sown and cut. The favourite apricots and peaches are grafted on to Damasc de Toulouse, causing them to come into cropping in two or three years. They appear to be very resistant to bad drainage in the winter. The trees are budded on to this stock 6 inches high.

The photograph on p. ii of the art inset shows M. Mortillet, of the Ostriconi Farm, Ile Rousse, with a six-year-old Dr. Jules Guyot pear cropping heavily. M. Mortillet is typical of the men who have come over from France to take advantage of the wonderful climate. They raise their own trees, budding the pears on quince stocks in the nursery in August and planting them out where they are to grow in December. They make a growth of nearly 4 feet when mature.

I was able to see a number of market gardens and many vineyards. The best of the latter appeared to be in the valley below Sartène. M. Gentili is a successful market gardener in the village of Afa near Ajaccio. He planted his potatoes in January and lifted them in June, and then followed with cauliflowers in early August, which he harvested in November so as to get the crop in time for All Souls' Day, when all Corsicans must have this vegetable! He gave me a very important tip about artichokes, pointing out that if you reduce the plants to one spike only, it is possible to get ten or twelve good heads for sale, whereas if you allow a number of spikes to develop, you get only five or six as a rule. This market gardener grows leeks for sale every month of the year, and he is harvesting new potatoes each month also. It takes only four months from the time of planting potatoes in the summer and seven months from the time of planting in the winter. A man like this, of course, can grow his own bamboos, as well as a fair acreage of oranges. Monsieur Gentili is a typical Corsican, whose wife and daughter incidentally "picked up" all the potatoes and did the bulk of the fruit picking too.

M. Joseph Cherchi is another grower who runs a successful market garden outside Ajaccio. He has specialized in tomatoes, melons and aubergines. Whereas I am glad to get two or three aubergines per plant in Thaxted, he thinks nothing of getting between twenty and thirty good fruits from each of his plants. He plants his tomatoes a yard apart on the triangular system and has three strong bamboos 6 feet high, forming a kind of "tepee". The plants grow 5 feet high and bear about 12 lb. of tomatoes each.

I was greatly struck with the possibilities of the island and was privileged to meet the French Minister of Agriculture, M. Sourbet, who flew over from Paris with his wife. I feel sure that under the supervision of the new Director of Agriculture a great step forward will be made. Corsica can become a great exporting island if her people will only set to work with a

will. There is good alluvial land on at least 50,000 hectares, and the climate is almost perfect. Water is available and there should be no difficulty in controlling pests and diseases.

I should like to thank M. Sourbet, the French Minister of Agriculture, the Chef de Cabinet to the Ministry of Agriculture and the Préfect of Corsica, M. Marcel Savreux, for all their kindness, help and hospitality: also the Acting Director of Agriculture, M. Guy Keller, for taking me round the island and for correcting this article. My thanks are also due to the growers whose names I have mentioned in the article, not only for the information which they gave, but also for their liberal hospitality.

THE MINISTRY'S PUBLICATIONS

Since the date of the list printed in the September 1955 issue of AGRICULTURE (p. 294), the undermentioned publications have been issued.

MAJOR PUBLICATIONS *Copies are obtainable at the prices quoted from the Sale Offices of H.M. Stationery Office or through any bookseller.*

Bulletins

No. 42 The Feeding of Dairy Cows (*Reissued February 1955*) 2s. 6d. (2s. 7½d. by post)
No. 84 Apple Grading and Packing (*New*) 4s. 6d. (4s. 7½d. by post)
No. 154 Grassland Management (*Revised May 1955*) 3s. (3s. 1½d. by post)
No. 156 Cane Fruits (*New*) 2s. 6d. (2s. 7½d. by post)

Other Publications

Report of the National Agricultural Advisory Service: The First Eight Years, 1946-1954 (*New*) 3s. 6d. (3s. 8d. by post)
The Milk Marketing Scheme 1933 (*as amended to June 27, 1955*) 1s. 9d. (1s. 10½d. by post)

LEAFLETS *Up to six single copies of Advisory and Animal Health Leaflets may be obtained free on application to the Ministry (Publications), St. Andrew's Place, London, N.W.1. Copies beyond this limit must be purchased from the Sale Offices of H.M. Stationery Office, price 2d. each (3½d. by post).*

Advisory Leaflets

No. 215 Gooseberries (*Revised August 1955*)
No. 299 Brussels Sprouts (*Revised August 1955*)
No. 441 Nitrogenous Fertilizers for Farm Crops (*New*)
No. 443 Potash Fertilizers for Farm Crops (*New*)

FREE ISSUES *Obtainable only from the Ministry (Publications), St. Andrew's Place, London, N.W.1.*

Growmore Leaflets

No. 106 Potatoes in Allotments and Gardens (*New*)
No. 112 How to Grow Soft Fruit in the Garden (*New*)

COCKFLAT FARM

J. M. EWING, N.D.A., N.D.D.H.

National Agricultural Advisory Service, Yorks and Lancs Province

A modest programme of reseeding old pastures and reclaiming bracken-covered hillside grazing on a North Riding upland farm is already paying good dividends in terms of increased stocking, lower costs and more winter keep.

THE farm of Cockflat, in Bilsdale in the North Riding of Yorkshire, covers about 160 acres, of which just over half is classed as rough grazing. Shorthorn cattle are kept and, in addition to small pig and poultry units, there is a flock of some 100 Swaledale ewes. Like many other upland farms, grass has been the weak link in the chain of production. The task of strengthening the link was first started towards the end of 1950, when plans were laid to put the plough into some of the worn-out pasture and rough grazing. Carrying out the programme was, however, clearly going to take time.

A start on the work at Cockflat was made by ploughing up 8 acres of worn-out grass and 3 acres of bracken-covered hillside. A certain amount of ditching and some under-drainage were also done. This and all the field cultivations were carried out by the farm staff. Ground limestone, at the rate of 3 tons per acre, was applied to all the ploughed land. The eight acres which were to be sown direct to grass were given a dressing of 7 cwt. per acre complete fertilizer, which was worked into the seedbed. A cocksfoot ley was sown and, after heavy grazing in the latter part of the summer, a dressing of 10 cwt. per acre medium-grade basic slag was given. The bracken area was worked as well as the difficult hillside conditions permitted and put down to a mixture of rape, mustard and Italian ryegrass, which received a 4 cwt. per acre compound fertilizer. This crop paid handsome dividends in the form of valuable keep for the lambs. After the lambs had finished there were still useful pickings for the ewes. The area was worked from the top in the following spring and sown direct to grass with a further dressing of 6 cwt. per acre complete fertilizer.

To ensure adequate grazing control of the improved areas, it was necessary to erect a considerable amount of new fencing. Posts for this were cut on the farm, and very satisfactory fences made with pig netting plus a strand of barbed wire on the top.

By the time the 3 acres of hillside were ready for seeding, the plough had again been busy. A further 9 acres of old grass had been ploughed out and another 3 acres of hillside were earmarked for the same treatment. The 9 acres were again sown direct to grass, but although the lime and fertilizer treatments given were the same, variations were made in the seeds mixture. Instead of a cocksfoot ley, more balanced grazing was aimed at by the sowing of a timothy/meadow fescue mixture. The second 3 acres of hillside received the same treatment as its predecessor—namely, a pioneer cropping followed by direct reseeding.

Young Stock Nearly Doubled So much for the details of the improvements to date. Now let us turn to the conditions at Cockflat which brought about the changes in husbandry and the effect which the changes have had. To many, the acreages involved

(17 acres of rough grass and 6 acres of hillside) may not appear particularly high, but on this farm it means that about one-fifth of the in-bye land has been improved. In addition, 6 acres of very rough land have been brought into the more productive section of the farm.

Before the reseeding programme 13-14 cows were run, with up to 18 other cattle. The off-lying land (now reseeded) was very unproductive—with difficulty it summered only 5 yearling stirks and a pony. Young stock had, therefore, to be kept near home in direct competition with the cows. The reseeded area is some considerable distance from the steading and it is quite impracticable to use it for the milking stock, but the improvements to the off-lying land have increased the stock-carrying capacity so considerably that all the young stock can now be carried there, thus greatly easing the grass position at home.

The layout of the home fields is such that strip grazing, using the electric fence, is hardly convenient. Even so, intensive management is aimed at by block grazing, the cows being rotated round 2-3 acre paddocks.

Although there has been little change in the cow population, the number of young stock run has been nearly doubled in the last five years. Of course, this rapid increase in stocking brought with it certain housing difficulties, and if full benefit were to be obtained from the extra stock something had to be done about it. Steps were therefore taken to alter an old wheel-house to accommodate more stock. The floor was cemented and standings for 16 strong stirks were installed. This work was done by the farm staff, so that expense was kept to the minimum.

In addition to the increase in stock numbers, the following benefits have been directly derived from the reseeding:

1. It is now possible to finish a small number of cattle off grass—a practice which had never been possible before.
2. The Swaledale lambs are being taken through to heavier weights and, by leaving greater returns, help to offset the costs of the pioneer crop.
3. More and better quality hay has been obtained. The extra hay is a valuable insurance against a severe winter or a late turning-out time.

The improvement programme is designed to carry on this year, when yet another small area of rough hillside is being brought into production by pioneer cropping and reseeding. This last piece, well up the hillside, will provide a bit more grazing for cattle and sheep, as well as giving better access to the hill and providing a holding and feeding ground for the ewes. It must be appreciated, however, that the initial ploughing, fertilizing and reseeding form only part of the improved grassland story. To maintain the output of the grass, good management and regular fertilizer maintenance are absolutely essential. Given this, the answer to the question "Was it worth it?" will certainly be "Yes!"

SHEEP-DOGS ON TRIAL

SYDNEY MOORHOUSE

The genuine sheep-dog trial, of which the International Sheepdog Championship is the supreme event, provides a searching test of dog and shepherd in conditions which simulate very closely those under which they normally work.

SCOTLAND has always been regarded as the true home of the Border Collie—the working dog that is used on the great sheep runs of the world—and it was perhaps only fitting on the occasion of the last International Sheepdog Championships, held at Edinburgh in September, that Scottish handlers should win five of the six individual contests and also take the team award. In the only championship to go outside the home country, that for driving, the winning Englishman was using a Scottish-bred collie!

It is generally accepted that the art of working sheep by using a trained dog is one that really originated in Britain, for although there are records of dogs being used in connection with sheep as long ago as Biblical times, the evidence is such as to suggest that those used by the farmer of Uz and his contemporaries were intended mainly to guard the flocks and were not called upon to work sheep in the same way as the modern sheepdog. On the other hand, we have that really remarkable passage in a late sixteenth-century work, entitled *Treatise on English Dogs* and written by Dr. Johannes Caius, telling us how the shepherd's dog, "either at the hearing of his master's voice, or at the wagging of his fist, or at his shrill and hoarse whistling and hissing, bringeth the wandering wethers and straying sheep into the self-same place where his master's will and work is to have them, whereby the shepherd reapeth this benefit, namely, that with little labour and no toil or moving of his feet he may rule and guide his flock".

The dogs known to Dr. Caius were most probably akin to the Old English Sheepdog, the woolly-coated breed so finely portrayed by Gainsborough in some of his paintings but rarely seen as a working dog today; and in a book about the breed, written by Mr. Aubrey Hammond and published in 1908, it is suggested that another ancient strain—the Bearded Collie—had a common origin. From the last-mentioned was probably evolved the Border Collie. Mr. James A. Reid, who, as Secretary of the International Sheepdog Society for thirty-two years, did more to stimulate interest in the Border Collie than any other man, claims Scotland as the place of origin of the breed and goes on to say: "The collie got into Northern England mainly in the great droving days covering the whole of the eighteenth century and the first half of the nineteenth".

It is, of course, inevitable that fashions in sheep-dogs, just as in cattle and horses and, especially, in other breeds of dogs, should change with the passing of years, and although the Border Collie has doubtless altered in general appearance since the droving days of a couple of hundred years ago, it has always been bred (and exhibited) for its working qualities rather than for body conformation. The late Mr. A. Croxton Smith once described Border Collies as "unimproved collies", adding that "they are very much like the collie used to be before he was taken in hand by exhibitors!"

In 1790, Thomas Bewick, the Northumbrian engraver, published his *General History of Quadrupeds* and included in it a black-and-white draw-

ing of a shepherd's dog which is readily comparable with the present-day Border Collie. There also seems little doubt that many of the collies known and described by such men as Sir Walter Scott, James Hogg (the "Ettrick Shepherd") and Robert Burns would not look out of place on many hill farms today.

Old Hemp—Foundation Sire Undoubtedly, the most important step towards the evolution of the modern Border Collie took place in 1893, when an Otterburn farmer, Adam Telfer, mated a dog named Roy—a dog (as his son, another Adam, once informed me) with a very "free" eye and frank expression—with Meg, a shy and rather self-conscious bitch. From this mating came Old Hemp, now universally regarded as the foundation sire of the existing type. Mr. J. Herries McCulloch, in his *Sheep Dogs and their Masters*, has given us a good pen picture of this remarkable dog, based on the accounts of those who knew him.

> *He ran, or rather ambled, after sheep when he was six weeks old. He was so completely governed by the instincts of the Border Collie that he was never actually trained to work with sheep; he knew what to do without being trained. His eye was tremendously strong and blazed whenever he approached sheep. When standing watching sheep—he seldom lay down when doing so—he always trembled violently.*

Hemp set up what might well be called a distinct family within the sheep-dog world, a family whose characteristics were so strong that in time it enveloped most of the rest. Indeed there is hardly a pedigree of an International championship winner, or even a noted trials' leader in Australia, New Zealand, and the United States of America, which has not its tap-root in either William Wallace's Tommy or Thomas Armstrong's Sweep, both grandsons of Old Hemp. This applies to the present International champion, James M. Wilson's Bill, and to Allen's Rock, the most outstanding collie in North America over the past few years. Early in the century Mr. James L. Moore, of Victoria, imported the strain into Australia, where descendants have been equally successful.

It will be noted that the descriptions of both Old Hemp and his sire, Roy, contain references to the "eye", which, of course, really means "the eye of control". It has long been accepted that no sheep can stand a dog staring at it while approaching, but fifty years or so ago the attention being paid to this quality resulted in many dogs using it to excess and so becoming "sticky-eyed", or, as many of my North Country friends have it, "ower strong i' th' eye". Trials soon revealed the obvious defects of this, for a dog which relied solely on the eye as a means of control was all right when it came to holding sheep stationary, but was useless when the flock had to be kept moving at a steady pace.

The International Championship The sheep-dog trial is a little older than Old Hemp's time, and was originally the idea of a Welsh squire, R. J. Lloyd Price, who promoted the first contest of which we have record at Bala, North Wales, in 1873. There were ten competitors and the winner was James Thomson, a Scotsman working in Wales and using a Scottish-bred dog, Tweed.

Before long the idea of holding sheep-dog trials had spread to other parts of Great Britain, and then came the formation of the International Sheepdog Society in 1906, having as its aim "to stimulate public interest in the shepherd and his calling and to procure the better management of stock by improving the sheep-dog".

Although "International" in name, most of the original members came from Scotland, with just a few Englishmen from Northumberland. Wales, the original home of sheep-dog trials, was not represented, and, indeed, sixteen years passed before any Welshman competed at the Society's championships. But in 1922, mainly as the result of the enthusiasm of Lord (then the Hon. E. L.) Mostyn, now President of the International Sheepdog Society, and Capt. T. M. Whittaker, who was one of the judges at Edinburgh this September, the trials were held at Criccieth and became fully representative affairs.

Today, the International Sheepdog Championship is one of the most popular pastoral events of the British season, and the results are keenly awaited by enthusiasts in all parts of the world, for the leading British strains are always in great demand by buyers from overseas. During the preceding weeks, however, England, Wales and Scotland hold their own national trials, and the twelve highest scoring collies at each of them go forward to the international event. Having got so far, they run over a course similar to that used at the national trials, and the first twelve—irrespective of country—go forward to the International Championship proper, which is held the following day.

This can fairly be described as providing the most searching test of a collie's skill ever devised. Ten sheep, 800 yards away from the handler, have to be gathered and brought 400 yards to pass between two hurdle gates. Then the collie has to leave them and go out to gather another ten sheep and bring them through the same gap. The two flocks are united and driven over a triangular course, passing through two more gates on the way. The sheep are then brought to a ring, 50 feet in diameter, and five of them, indicated by ribbon tied round their necks, have to be separated from the rest inside the ring before being driven into a pen 6 feet square. All this, which involves some three miles of running for the collie, as well as much difficult technical work, has to be accomplished within half an hour.

Tests akin to Farm Work Ever since its inception, the International Society has had as its aim the promotion of trials that would test the capacity of the collie for everyday work on the sheep farms, and it will readily be seen that the course described fulfils this purpose admirably. The initial outrun to sheep, which are out of sight when the collie begins its run, is a fitting replica of what is involved in gathering sheep scattered over a mountain slope or wide stretch of moorland. In making this run, the collie must sweep a wide arc in much the same way as would be necessary when working on a hill farm, and any neglect of this or cutting in before the sheep have been reached is heavily penalized. Similarly, the driving of sheep through gates is something which the collie is regularly called on to do in the daily routine of the sheep farm, and the separating out is a regular operation when certain sheep are required for marketing, treatment, etc.

The utilitarian value of sheep-dog trials, like that of the ploughing match, has been the subject of criticism from time to time, and it must be admitted that in recent years there has been a tendency in many places to promote sheep-dog trials on grounds that are far too small—cricket fields and the like—and to introduce "stunt" tests purely for the sake of entertainment. Such practices are frowned upon by the International Society, and it is significant that the collies which win at these smaller trials are rarely successful in International contests, where the long outrun often proves their undoing.

Working Dogs and Shepherds The sheep-dog trial is, of course, primarily a test, and like all tests has sometimes to be modified, as in Australia and New Zealand, where trials corresponding more to the peculiar needs of the countries have been evolved. But the trial does test the qualities essential to a good collie, and most International championship winners of recent years have been every bit as good when working on their own hillsides as on the trial course. James Wilson, whose Edinburgh win was his ninth International victory since 1928—a record unequalled by any handler in the history of sheep-dog trials—is one of the most prominent breeders of Blackface sheep in the country, as evidenced by the high prices that have been paid for his ram lambs at the Lanark sales. The 1954 champion, Jack Macdonald, is a working shepherd on the hills above Lauderdale, and as such has neither the time nor the inclination to keep dogs purely for exhibition.

Contemporary accounts of that first trial in 1873 indicate that it was a noisy affair, with a lot of shouting and a deal of frenzied work in front of the final pen. Today, there is a quiet efficiency in the work of both handlers and dogs. And not only has the standard of working improved almost out of recognition, but it is an established fact that sheep handled in this way are much better for it. At Edinburgh one heard many remarks concerning the fitness and wonderful condition of the Blackface sheep being used. They gave every appearance of having been well handled by expert shepherds and good dogs, and they came from the farm of Mr. J. R. Hislop, of Gordon, who has himself won many awards in sheep-dog trials and championships.

SEASONS—GOOD AND BAD

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Weather wisdom based on old sayings may, more often than not, be misleading.

GLANCING recently through a book entitled *Weather Lore*, compiled by Richard Inwards at the end of the last century and republished a few years ago by the Royal Meteorological Society, I was intrigued by a number of seasonal weather forecasts. These pretended to foretell the weather of a coming season with reference to the weather of a past season. The interesting questions that spring to mind are whether the sayings are true and why such sayings originated. Perhaps in some cases it was wishful thinking, in others a semi-superstitious feeling that good fortune (or good weather) must be followed by bad. Possibly, certain sequences of weather did occur fairly frequently over a short period of years and thus impressed themselves on the minds of one generation. Unless there is a direct cause and effect, such sequences are due to chance and are unlikely to occur so frequently again. There is much wisdom in the sayings and practices of the oldsters, but that does not mean every old wives' tale is an incontrovertible truth.

Any attempt to check the validity of these weather sayings needs a long series of records, and luckily we have these in *A Century of London Weather*

(published by H.M.S.O.). The wealthy fund of data which this book contains are sheer delight for those who like playing with figures. This book gives us the pattern of the weather of the seasons from 1840 to 1949, showing the distribution of, say, rainfall throughout the century, which we can summarise as follows (years):

	Very Wet	*Wet*	*Average*	*Dry*	*Very Dry*
Spring	9	41	39	29	11
Summer	24	39	24	46	23
Autumn	24	42	34	33	18
Winter	17	33	35	41	19

The numbers in each column depend on how we define our "wet", "dry" years and so on, but having chosen a reasonable classification, the weather itself has defined the pattern of the seasons. Note that the three middle columns add up to 109: the end columns are extreme cases and the "very wets" are included in the "wets", as indeed they must be.

Consider the 46 dry summers; if the rainfall the following autumn is unaffected by this type of summer, then the 46 following autumns will be expected to follow the same pattern as the whole 109 autumns; namely, 42 wet, 34 average, 33 dry. By simple proportion, we get:

	Wet	*Average*	*Dry*	*Total*
Expected autumns ...	17.7	14.4	13.9	46
Actual autumns following dry summers	19	13	14	46

From these figures we are surely justified in saying that a dry summer shows little signs of influencing the wetness of the following autumn.

The temperature pattern is, in similar fashion:

	Very Warm	*Warm*	*Average*	*Cold*	*Very Cold*
Spring	7	27	37	45	16
Summer	11	36	28	45	19
Autumn	9	29	34	46	15
Winter	11	27	29	53	35

If the winters which follow the 45 cold springs belong to the general pattern, they should be divided in the ratio 27:29:53, namely:

	Warm	*Average*	*Cold*
Expected winters after 45 cold springs	11.1	12.0	21.9
Actual winters experienced	5	13	27

This rather suggests that mild winters have been at a discount after cold springs, but I cannot trace any weather saying which implies this state of affairs. Strangely enough, there have also been less wet winters after cold springs, only 8 having occurred when one would have expected between 13 and 14. Let us look at a few of these old sayings and test their truth by comparing the actual with the expected seasons, the expected seasons being deduced from the pattern of the century.

If the spring is cold and wet, autumn will be hot and dry

CHECK: There were 45 cold springs, 41 wet springs and 19 cold, wet springs.

	Hot Autumns	*Dry Autumns*
Number expected after 45 cold springs	12.0	13.6
Actual number occurring	9	16
Number expected after 41 wet springs	10.9	12.4
Actual number	11	12
Number expected after 19 cold, wet springs	5.1	5.8
Actual number	3	6

VERDICT: Not proven.

A dry spring, and rainy summer

CHECK: There were 29 dry springs.

	Very Wet	*Wet*	*Average*	*Dry*	*Very Dry*
Summers expected after 29 dry springs	6.4	10.4	6.4	12.2	6.1
Actual summers experienced	1	8	6	15	8

VERDICT: If anything, the reverse has been more often true, for we have had only one very wet summer in 109 years which followed a dry spring (but we had another in 1954).

Generally a moist and cool summer portends a hard winter
A wet summer almost always precedes a cold stormy winter

CHECK:	*Expected Cold Winters*	*Actual Cold Winters*
After 27 cool and wet summers ...	12.9	16
After 39 wet summers	19.0	20

VERDICT: There were not appreciably more cold winters following this type of summer than one would expect from the general pattern, but notice that there were many cold winters during the last century, so that this type of forecast had a 50-50 chance of being correct whatever kind of summer was specified.

A very hot and dry summer is sometimes followed by a hard winter

CHECK:	*Expected Cold Winters*	*Actual Cold Winters*
After 19 hot dry summers	9.1	9

VERDICT: The operative word is " sometimes ".

A wet autumn indicates a cold and early winter

CHECK:	*Cold Winters*	*Very Cold Winters*
After 24 very wet autumns we would expect	11.5	7.5
and we actually experienced	19	13

VERDICT: 19 successes out of 24 attempts is pretty good. Past history suggests that this is a useful adage, but only the future will show if it will remain true.

A warm and open winter portends a hot and dry summer

CHECK:	*Summers*			
	Dry	*Very Dry*	*Warm*	*Very Warm*
Expected number after 27 mild winters	11.4	5.7	8.9	2.7
Actual number experienced ...	15	9	11	7

VERDICT: There certainly seems to have been more very warm summers following mild winters than one would have expected. Nevertheless any forecast made after the end of the mild winter would have only a 3 to 1 against chance of success!

Too fine a winter will swamp the summer

CHECK:	*Wet*	*Very Wet*
Expected summers following 41 dry winters ...	14.7	9.1
Actual summers ...	14	8
Expected summers following 19 very dry winters ...	6.8	4.2
Actual summers ...	7	4

COMMENT: There is no evidence at all in favour of this saying. If we interpret the words " too fine " as meaning a sunny winter, we find a similar result. On the other hand, 28 dull winters have been followed by 17 dry summers; the expected number is only 12.4, so there might have been more justification for saying " Too dull a winter will burn up the summer ".

Only the fifth saying—about wet autumns and cold winters—seems to have survived this cross-examination without loss to its character. There is only one infallible way to build up a reputation for seasonal forecasting and that is to quote the appropriate saying after it has come true. The cold light of true statistics rarely beats upon casual conversation.

MARKETING WOOL

A. T. Brooke

Ministry of Agriculture, Fisheries and Food

Now synthetic fibres are challenging the supremacy of the old staple product. Efficiency in marketing is therefore of crucial importance. Producers themselves have played a most important part in the organization of the market.

THERE is a fascination about the story of wool. From time immemorial this staple product has figured prominently in world commerce and the history of man. Much of that fascination derives from the wide diversity in the pattern of its production and use. Each variety of wool has its peculiar attributes of length, fineness, suppleness and "waviness", which dictate the uses to which it can be put. There is, for instance, a world of difference between the wool of Kashmir and that of the Romney Marsh; yet each has its virtues. Regional specialization in manufacture followed as a natural development, ranging from the familiar English broadcloths or Harris tweeds to the exotic carpets of Bokhara, Numnah felts, and the black and orange striped blankets of North Africa.

Such specialized products must have arisen from the development of local wool to its best use, followed by a wider appreciation of their value as improved transport opened up new markets. We can see this happening today in the export of Shetland knitted wear, hand-made by the Island crofters from the wool of their own special breed of sheep. Initially, the marketing of raw wool is a local matter. As soon, however, as any significant degree of mechanization enters into production, wool processing tends to become centralized. The skill and technique of processing ceases to have any connection with local wool production, and long-range trade in raw wool develops. In the fourteenth century it was the weavers of the (relatively) densely populated Low Countries who created the great demand for English wool, just as it was the weavers of Bradford who created the demand in the nineteenth century for the wool of Australia and New Zealand. New specializations in manufacture can thus develop which require special wools from the other side of the world.

Wool presents little difficulty in transport, whether by pack saddle or cargo ship; it is not seriously perishable and, when baled, not bulky in relation to its value. It is these factors which have led to the world-wide market of today.

Historical Background British woollen cloth was exported to the Continent from the time of the Roman occupation. By the twelfth century, raw wool was our principal export, and the demand for it abroad so great that control of its marketing was a valuable strategic instrument to the Government. English wool was essential to the weavers of medieval Italy and Flanders, and when the supply was cut off the population of Flemish weaving towns declined abruptly. Wool built our finest churches, financed our armies, and on occasion paid our king's ransom. Although hazardous, by reason of frequent changes in the law and the tax, and the chance of shipwreck or war, the trade was highly organized. On some occasions, we know that merchants from Italy bought directly whole clips of the great monasteries, even for years in advance. At other times, English merchants obtained the monopoly of sale right through to the great fairs of

Flanders and Burgundy. Enormous taxes were raised on exports. The fate of Edward I was evidently thought not unfitting "because he sinned against the wool-mongers, he was drowned in a ship laden with wool".

National policy had, however, for long been tending in the direction of encouraging home production of cloth rather than export of wool, and for more than 150 years there was an absolute prohibition on the export of wool. This created a widespread and profitable enterprise in smuggling, but it meant that the legitimate market for wool ceased to be Continental and became once again domestic. Prices were lower, and although the British Isles remained, up to the eighteenth century, probably the largest producer of wool, by the time of the Industrial Revolution a change was taking place. The bias of our agriculture was turning away from sheep with wool as the product of primary importance, to crops and meat; wool was again being relegated to the position of a by-product.

World Market From having what amounted to a monopoly in fine wool (it was claimed in the seventeenth century that "there is not a piece of broadcloth or new drapery in France without the help of our wool"), the United Kingdom now produces only a very small proportion of the higher priced wools. Restrictions on the export of British wool were removed early in the nineteenth century, and the British cloth manufacturer now has to purchase most of his raw material from abroad. Today the great centres of production lie in the southern hemisphere—in Australia, New Zealand, South Africa and the Argentine—the first three producing around three-quarters of all wool entering world trade.

None the less, British wool is still exported. The characteristic feature of wool production in the United Kingdom is now the number of small flocks, representing over thirty breeds of sheep, with innumerable crosses. These yield certain irreplaceable speciality wools which are in demand for such purposes as knitting yarns and the felt used in the printing of bank notes, for carpets and for the Continental mattress trade. In fact, about a third of the United Kingdom clip goes overseas every year.

A number of foreign buyers are thus brought to sales in this country, but London is no longer the centre of the world market. Buyers now travel to the sales in Australia and New Zealand. This concourse of buyers creates a world price for the southern hemisphere merino and cross-bred wools, which in turn influences, though it does not absolutely control, the prices of all other wool entering world trade. Since this world market has developed, it has been no less speculative in character than was the European market of medieval times. In any one year, or indeed over a period of years, the output of raw wool is largely fixed by the number of sheep kept; while the demand for wool may vary enormously and, as the raw wool is only a small fraction of the cost of the final product to the consumer, the price which the buyers are prepared to pay may fluctuate even more widely.

This in itself presents a big problem for the wool producer, who seeks at any rate a certain stability in his price to enable him to plan from year to year. And wool is only one of a number of more or less alternative fibres entering into the world textile trade. Wool producers are bound to see in the increasing variety and expanding production of synthetic fibres a challenge to their future.

Producers' Organizations The response of wool producers to these difficulties has been remarkable. There is probably no world agricultural product in the marketing of which producers have taken a keener or more effective interest, not only at the producer to pro-

cessor stage but right through to the stimulation of demand for the finished product.

Producers in Australia, New Zealand and South Africa do not sell through their Wool Boards. A proportion of the brokering and merchant firms are owned by the producers, but, on the whole, trade in raw wool is on a private basis. A small and diminishing percentage (about 1 per cent) is sold on the farm by private treaty and later passes through the London Wool Auctions; but the vast majority of the clips are consigned direct by the producers to the port auctions in their own countries.

Such an arrangement is satisfactory to those growers who are large-scale specialists producing a very uniform product, the world price of which is widely quoted. The position is different for producers in other countries to whom wool is more of a sideline—men who have only a small quantity to sell or whose variety of wool is not closely related to quoted prices. It is difficult for them to sell their wool to the best advantage. The manufacturer is remote from the farm, and the value he will put on the wool depends on many factors—the state of the world wool market, the state of his order book, and the other wools (or indeed other materials) with which he will make his blend. The grading of wool is so little a matter of objective test and so much a matter of subjective comparison, that only a specialist, fully acquainted with the hundreds of grades available, can voice a useful opinion.

Hence non-specialist wool producers have now turned, with considerable effect, to co-operative trading. "Canadian Co-operative Wool Growers" was set up in 1918, and now sells approximately 80 per cent of the Canadian clip. In South Africa, producers' co-operatives act as brokers. In America, as in this country before the war, producers' co-operatives handle a significant, though not a major proportion, of the clip. Criticisms of the weakness of the sellers' position on the one hand, and the poor presentation of the product on the other, were made in much the same terms in reports on the pre-war marketing of wool in this country and in South Africa. Almost identical criticisms are to be found in the latest appreciation of the position in the U.S.A.

As a strategic raw material, wool was subject to rigid control during the Second World War. The whole of the United Kingdom clip was requisitioned and the task of collecting it vested in the "Wool Control". The producers received a price per lb., fixed according to the type and grade of wool produced, in advance of each shearing season. Assembly was entrusted to qualified merchants. The grower was directed to consign his clip to the merchant, and on arrival at the warehouse the wool was graded and the grower paid the scheduled price. The wool was later allocated to manufacturers.

The British Wool Marketing Board This system was continued after the war whilst examination of the means to stabilize prices and markets was undertaken. Then the Farmers' Union promoted a statutory scheme on fleece wool, which was accepted, and this product was added to the list of commodities in receipt of a guaranteed price and assured market under Part I of the Agriculture Act, 1947. The scheme, after a favourable producers' vote, came into force in 1950 and the Board has now been responsible for marketing the United Kingdom clip of fleece wool for five years.

The Board took over the war-time official organization as a going concern, and its assembly methods are basically the same. The Board employs about 140 authorized merchants to collect, grade, bulk and store the wool bought

from the 120,000 or so registered producers. The merchants act as agents of the Board and are paid for their services on a commission basis. The merchants sort and grade the wool collected from the producers into the recognized grades for which the Board has specified, in advance, maximum prices based on the average price guaranteed to the Board by the Government. Wools of the same grade are then bulked and later re-valued by the Board's own appraisers.

The Board disposes of all wool in a programme of auction sales at the main centres at Bradford, London, Exeter, Leicester, Glasgow, Edinburgh, Hawick and Belfast, the appropriate Committee of Wool Brokers acting as auctioneers. Sample bales representing large lots are on display at the centre several days in advance, so that intending purchasers may examine the wool and put their own value on it. The selling season and the volume of wool offered are spread over twelve months.

The Board has thus been successful in bringing a degree of organization and stabilization to the home-grown fleece wool industry which was lacking before the war. Producers know in advance the price at which wool of their type and quality will be bought by the Board. "Sell and repent, but sell" is no longer the wool grower's motto. He knows that his clip will be sorted for him and graded by disinterested appraisers, whether it is the output of a small or a large flock, and that the Board will carry the cost of holding the wool for sale later in the year. The buyer knows that the whole clip will be offered for auction in large graded lots according to the catalogue of an advertised programme of sale, without his scouring the countryside. The agents of the Board know what their commission will be. On the other hand, because United Kingdom wool is only some 10 per cent of total United Kingdom requirements, the Board is in no general sense a monopoly.

Furthermore, the Board advises and encourages the improved presentation by producers of their wool not only by publicity, but also by penalizing such defects as tar marking and dip stain. Improvements in this direction are being made, to the advantage both of producers and manufacturers. Meanwhile, without diminishing the services rendered, the Board have kept their expenditure remarkably steady in face of the general upward trend in costs.

International Retail Sales Promotion A joint conference of wool organizations which already existed on a national basis in South Africa, Australia and New Zealand, was held in 1937. The outcome was the formation of the International Wool Secretariat to advance a joint scheme of sales promotion and research. The funds for sales promotion come from a levy on every bale of wool grown in the three countries. The headquarters are in London; and, especially since the war, the campaign has expanded rapidly. Sub-offices are now open in all the main consuming countries of the world outside the Russian sphere of influence. The Secretariat encourages research into wool fibres and wool production, through studentships and fellowships offered to selected individual scientists and block subventions to existing research institutions. And its vigorous promotion activities include exhibitions, wool fairs, knitting competitions, fashion parades, window display contests, travelling shows, and educational literature under the general slogan "There is no substitute for wool".

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FARMING AFFAIRS

Men, Milk and Machines Labour economy is more important than ever in agriculture today, particularly where skilled labour is involved. Milking, for example, occupies much of a cowman's time, and efficiency in his case will depend to a large extent on the proper use of suitable milking equipment. The simplest and most easily corrected loss occurs when two men operate three bucket units. With this combination, the men must wait for the cows to milk out, and they are unlikely to be able to handle more than 13 cows per man-hour. Indeed, recent study has shown that two men operating three bucket units required nearly two hours each to milk 33 cows housed in cowsheds. A difficult cowshed layout contributed to this poor performance, but one extra milking unit would have saved 800 hours in a year and reduced labour costs by £120 a year! Alternatively, the labour saved by an extra machine could have been used to look after eight more cows. On a second farm, where milking was carried out by two men using three bucket units, a substantial saving has been obtained by the introduction of more suitable equipment. It was not possible to provide eight standings without expensive alterations to the buildings, but a six-unit, siix-standing auto-recorder saved £140 a year in labour. The herd has since been increased from 41 to 55 cows with little or no increase in labour requirements.

But the installation of another bucket unit for each man will not necessarily lead to a saving. Equipped with two bucket units, a cowman can milk about 19 cows an hour, but if he is given a third unit the cows are then likely to be kept waiting for the man. The best number of machines to use on any particular farm will depend upon the speed with which cows milk out and the cowshed or parlour layout. With a quick-milking herd or poor buildings, a cowman is likely to be fully occupied if he operates two bucket units efficiently. A good worker may handle three bucket units if a cowshed is particularly well planned, and a third unit can often prevent time losses in herds which include slow-milking cows. Herd size must also be a consideration. Although one man can sometimes operate three bucket units successfully in a small or medium-sized cowshed, two men will have greater difficulty in operating six units in a larger building.

In a milking parlour each man usually has three milking units, and this combination of men and machines appears to be generally successful. If only two units are provided, a milking parlour may offer no advantage over a cowshed. For example, in one parlour recently studied two men milked only 13 cows an hour each. The parlour is a new one, equipped with eight standings and four in-churn milking units, and such a performance implies little or no return on quite a large investment.

The provision of too many machines tends to be both a cause and a sign of slow-milking cows. For this reason, poor performances with a normal number of machines can often best be remedied by culling the slowest milkers from the herd.

G. H. Brayshaw

The Mechanic on the Farm: 20. Callipers in the Workshop Many of the measurements that need to be made in the farm workshop can be managed well enough with a rule, but in some jobs, particularly when worn machine parts are being examined, direct measurement is difficult. This is when hinged callipers are useful. They are not expensive and it pays to have several of different kinds and sizes.

The legs of inside callipers point outwards. They are inserted in a closed position into the bore to be measured, and are then opened out until the edges touch the sides of the bore. Then they are withdrawn carefully and the distance between the outer points of the bent ends measured on a steel rule. Outside callipers have legs which point inwards. They are adjusted at the hinge until the points just enclose the object being measured, and the distance between the points is ascertained as before.

Care must be taken to see that callipers do not move at the hinge while they are being withdrawn from the work or being handled on the rule, so the joint must be kept fairly stiff. But firm-jointed callipers are not at all easy to adjust in small stages by gentle pressure, and it will be found that the best way to move the legs a little wider or narrower is to tap one branch of the callipers on a hard surface.

To overcome the risk of movement while being transferred to the measuring rule, some callipers are fitted with a spring-loaded screw-adjustment. In inside callipers of this type the spring acts to spread the legs apart, and the range of movement of the legs is restricted by a knurled nut on a screw. Even if the legs are pressed inwards while the callipers are being withdrawn from the bore, the spring will return them to the measured position as soon as they are free. In outside callipers the spring movement tends to bring the legs together.

More than one diameter may, of course, have to be measured when the object of the investigation is to detect the effects of wear. For example, the cylinders of internal combustion engines wear oval, the long axis of the oval being usually in the plane of the rotation of the crankshaft.

The amount of wear tolerated in a cylinder of an internal combustion engine is small and is measured in thousandths of an inch. Although an ordinary calliper will indicate whether one diameter is larger than another, it is not possible to measure the separation of the callipers accurately enough to allow reliable numerical comparison. When very accurate measurements are needed, vernier callipers, which have a ten-division scale sliding against a 9-division scale, are used. Such callipers are, however, justifiable only in workshops which undertake major overhauls. Direct-reading automatic callipers are also made for use in workshops where bore measurements have to be made frequently. The measurement is indicated on a dial, and inside callipers of this kind have various sized cross-pieces for different bores, so that each instrument can be used over quite a range of sizes.

Jenny, or odd-legged, callipers have one leg straight with a sharpened point, and one curved. An example of their use is the finding of the mididle of the cross-section of a bar. The jenny callipers are opened to just a little less than the radius of the bar, and then short arcs are scribed on the section surface from four positions round the circumference. The true centre lies somewhere in the middle of the small figure drawn, and it can usually be gauged nearly enough by eye for a punch mark to be made.

H. J. Hine

Farm and Forest: 9. Trees for Idle Acres

The planting of woodland on new ground is normally limited in Britain to the poorest of soils, including the so-called "marginal" lands. Good agricultural land is too valuable for tree planting, but on many farms there are idle or doubtfully productive areas that could well be used for the growing of a useful and economic tree crop—useful as shelter for beast and crop and as a future source of timber for the farm. These idle acres

may be bracken-covered slopes, sandy heaths, sparse thorn downland, heather moorland or rush-covered marshland. All are quite suitable, after treatment, for growing trees.

The best way varies with the soil and the site. Bracken generally indicates a well-drained, open soil requiring little treatment, but even on such sites ploughing, wherever possible, ensures better growth, less weeding and quicker establishment of the trees.

Where there is a hard " pan ", deep ploughing and subsoiling are essential. Heather moorland means either a hard compacted soil, overlaid with a shallow layer of peat and with a hard "pan" underneath, or a deep peat—conditions under which no tree will flourish. Here again, deep ploughing is the answer. It disrupts the pan, improves the drainage, provides a planting medium and, in the early stages, eliminates root competition from the heather. Even on sandy heaths some soil disturbance is desirable.

Planting on chalk downland, where there is a combination of a dense grass mat and a shallow soil, is a difficult problem. On such thin soils deep ploughing is inadvisable; moisture must be conserved but, at the same time, competition from grass and weeds must be reduced. Very shallow complete ploughing or rotovating and discing with heavy discs are the most satisfactory methods. On steep slopes, where mechanical cultivation may not be possible, " screefing ", or the paring away of surface vegetation with a mattock, of the vegetation by hand in 18-inch or 2-foot square patches where the trees are to be planted is recommended.

Marsh ground and rush-covered valleys require extensive drainage. On large areas this is best done by ploughing, the furrows being led into the main drainage channels. The furrow slices then provide the mounds in which the trees are planted. For small or scattered areas, however, draining and turfing by hand is still the best method.

On most sites, therefore, ploughing in one form or another is generally beneficial. It enhances fertility, improves drainage, checks weed growth, simplifies line planting and reduces the fire risk. Any land to be planted must be reasonably well drained. Open ditches are the rule, for tree roots would soon clog tile, pipe or mole drains. The siting of these ditches is important. They must intercept water entering the area and must carry it away freely yet without risk of flooding. Sudden changes in the direction of flow and of gradient should be avoided. In addition to the main channels, subsidiary drains, or " feeders ", leading in to the principal ditches and running at right angles to the natural seepage of the surface water, will be required.

Fencing against farm animals and rabbits is nearly always necessary to safeguard the crop in its early stages, and it is thus very important to consider the area and the shape of the piece of land to be planted. The larger and more compact the area, the cheaper will be the cost of fencing. It remains to be seen whether the present drive to eliminate the survivors from myxomatosis will make the use of rabbit netting unnecessary in future.

IN BRIEF

Virus Control of Cabbage Caterpillars

Work at the Virus Research Unit of the Molteno Institute, Cambridge, seems to offer a likely means of controlling attacks by the caterpillar of the cabbage white butterflies. There was a veritable plague of them this year, especially in south-west England. In one collection it was noticed that many were dying and that others had ceased to feed. Bacterial infection commonly causes this kind of thing, but in this case the caterpillars were not only dying, but were actually liquefied. The cause, as revealed by the electron microscope, was a virus of the granulosis type—that is, where the virus is contained inside a capsule or granule and not free within the cells of the infected insect.

The story is told by Kenneth Smith and Claude Rivers in *The Grower* dated October 22. The first sign that caterpillars are infected with the virus is loss of appetite, so that plant damage stops quickly. Deterioration is rapid, until finally, the caterpillar, hanging down in a greeny state, disintegrates completely. The skin ruptures, and the completely liquefied body contents are dispersed about the leaf and plant. The virus is extremely virulent and is spread mainly by the larvae eating contaminated food. A mere trace is sufficient to infect a healthy caterpillar. The habit, too, which healthy caterpillars have of eating the diseased bodies of their companions, promotes the virus attack still further.

Production of the virus and spraying crops with a weak suspension of it will be carried out at the Molteno Institute next year. If successful, such a method of control would be very cheap.

Quality in Dutch Pigs

One-third of the pigmeat produced from the two million pig population of the Netherlands today is exported. And to meet world competition and the housewife's preference for lean meat, the Dutch breeder has had to revise his breeding methods considerably. Before 1940 the emphasis was on bacon; now exports of meat products far exceed those of bacon.

In this changeover from quantity to quality, the provincial herd books have played a big part. For entry in the herd book the animals are inspected for conformation, with special regard to type. The breeding pig must be of substantial build and the relation between fore, middle and hind quarters must indicate a good slaughter type. The aim is a porker with a muscular back and heavy, well-formed hams. The neck must be dry and not flabby, as this suggests a tendency to put on too much fat.

Co-operative associations of Dutch breeders and boar-keepers also assist in improving the pig population, giving special attention to the quality of the male breeding stock. They also look after the marketing of redundant breeding material.

But perhaps the greatest contribution in the drive for better stock comes from the litter-testing stations. On these stations, litters of four piglets, coming from parents with a good conformation, are fattened, after which slaughter quality, growth and feed consumption are judged. When the animals have a good slaughter quality and a sufficient daily weight increase with a low feed consumption, the dam of the litter is given the distinction of " star sow ".

Fertilizer from the Air

Fertilizers now drop "like gentle rain from heaven on the place beneath". For the year ended March 31, some 279,000 tons, practically all superphosphate, were spread by aircraft on pastures in New Zealand. This is more than one-third as much again as was similarly spread last year. Six years ago the figure was only 5,000 tons.

Before the war much of New Zealand's hill country pasture was declining in fertility—a situation which was aggravated by shortages of fertilizer and labour during and immediately after the war. Scrub and fern land had spread and the sheep-carrying capacity of the hill pastures greatly reduced in consequence. Recovery of this land, inaccessible to wheeled, and even track vehicles, has thus now been made possible.

Blackfly on Beans

Dr. M. J. Way, of Rothamsted, writing in the October issue of *The Agricultural Review*, says that one good spraying of beans will effectively check blackfly. The date of the spraying depends, of course, on the seasons —towards the end of the second week of June in an early season, and at the third week in a late season. Spring beans should be sown early (February to mid-March) in rows about 2 feet apart, which allows room for the tractor wheels and for the spray nozzles to be concentrated over the rows—100 gallons an acre at Rothamsted.

Gamma-BHC, nicotine, parathion and some systemic insecticides, such as demeton, have given good control. True contact insecticides, such as DDT, depend so much on an efficient coverage that they are ineffective against blackfly in practice. The systemics, which are absorbed and translocated by the plant, will kill those aphids which are not hit directly by the spray. Work on control measures at Rothamsted is still going on, special attention being paid to the question of low-volume application.

Dr. Way lays special emphasis, however, on the fact that spray control of blackfly will not guarantee a reliable crop without good husbandry. This includes early sowing. Late sowing reduces yield in any event, and if the crop is attacked by blackfly the damage is more severe and spray control more difficult than on an early-sown crop.

Bird-scaring the Modern Way

It is a far cry from the old turnip-headed scarecrow to the latest mechanical bird-scarer. This is an imitation hawk, invented by the Horticultural Engineering Institute at Wageningen, Holland. A cross-beam 5 metres long, erected on the top of a mast 15 metres high, is swung round by means of an electric motor fitted with a reduction gear. The imitation hawk, made from metal and wood, is attached to the cross arm by a nylon string. As the arm rotates, the string runs out and the "hawk" can fly out to a distance of 30 metres.

Flight from the Land

In Sweden it is estimated that 100,000 workers have left the countryside for the towns since the end of the war.

Animal Pests in Western Australia

Among animal pests, rabbits, rats, foxes, grey squirrels and wood pigeons give the British farmer the most trouble. The farmer in Western Australia, however, has by comparison to contend with some thirty or so pests officially listed as vermin. These include rabbits, kangaroos, dingoes, foxes, emus and wedge-tailed eagles, which are mainly responsible for the heavy losses to the agricultural and pastoral industries, and, except for rabbits and kangaroos, vermin bonuses are paid for their destruction.

Mr. C. D. Gooding, writing in the *Journal of Agriculture for Western Australia*, refers to the age-old and continuing competition between man and wild life for the "fruits of the earth". The early separation of Australia from other land masses gave this continent fauna which can in many cases be described as living fossils; most of the truly native species are either marsupial or lower forms. They cannot compete effectually with the higher forms of animal life which have been introduced and now constitute the most serious pests.

The dingo was probably introduced from the north by some sea route about 6,000 years ago. The swarms of rabbits which today plague millions of fertile acres derive from the few liberated in the Eastern States to provide food and satisfy the sporting requirements of the early colonists. Rabbits had no natural enemy in Australia that could hold them in check. The dingoes killed many but exercised very little control. In an effort to control this pest, foxes were introduced into Victoria about 1868 but, like other introductions, they found a favourable environment with little competition and so rapidly increased in numbers and spread.

In its unimproved state, much of the pastoral land of Australia was waterless for most of the year. Kangaroos would move in only when surface water was available and normally could not remain there for any length of time. But when bore-holes were sunk and water was made available in these formerly arid regions, the kangaroos quickly increased their numbers and range.

Queen of the Plough

At the National Ploughing Championships which will be held in Ireland in February 1956, there will be certain novel features. The winner in the section for girls will receive a substantial cash prize, and will be declared Queen of the Plough for 1956. She will be given a solid silver crown to hold for twelve months and to wear at official engagements and agricultural functions during the year. There will also be a marriage incentive fund, out of which £100 will be paid to the Queen of the Plough if she marries before her twenty-fifth birthday and settles on the land.

Skunk in the Corn

What do you do when you find skunk in threshed grain? This is a problem with which some Saskatchewan farmers were faced this year, when they found that skunks had been accidentally "threshed" during combine operations. Hopes of removing the offensive odour from the combine parts have been pinned to washing them with petrol or some other solvent. But the problem of treating the grain remains!

BOOK REVIEWS

A Border County. HENRY TEGNER. Hale. 16*s*.

Nowadays English naturalists fall into two distinct classes—those addicted to field sports and who are attracted to natural history thereby, and those to whom nature study is an end in itself, without killing for sport. These two categories have not always existed; indeed they are of comparatively recent origin, though today more marked than ever before. Most of the great naturalists of the past were sportsmen first, and others were never averse to using a gun upon the creatures of the countryside. The so-called human trend, sincere in itself, naturally gets little support from the field sports enthusiasts nor, for that matter, from the farmer, who sees clearly that some creatures have to be kept down; and if the keeping-down may be made an occasion for sport, then so much the better. Probably there is a need for both types of wild-life observer.

Mr. Tegner is in the best traditions of the first class. To him, sport provides the major interest, but it does not obscure his view of bird and beast, and he is a painstaking naturalist in his own right. This is his best book; a fresh, enthusiastic yet never dogmatic account of the county of his adoption and the wild sport which it offers to a man of his catholic taste and open mind. As such, it will come as something of a revelation to those elsewhere who regard Northumberland as a bleak and barren stepping-stone to Scotland. There is hunting on the moors and hills with "little of the social side", the main object being to preserve the northern sheep. There is coursing, first-rate sport with the increasing black game, occasional opportunities with roe deer, wildfowling on the coast and flats, trout and salmon, and much unpublicized grouse-shooting.

Mr. Tegner describes them all with experience and a friendly style, and leavens his sporting accounts with interesting notes on the county's other notable creatures, especially the grey seals of the Farne Islands, the Chillingham herd of wild white cattle, and the blue-grey Cheviot wild goats. This is a delightful book, ranging far and wide in subject-matter, but kept purposeful by the author's tolerant personality. In his pages he frequently quotes the late Abel Chapman: this book confirms that Henry Tegner is in direct line of succession.

D.G.

Shopwork on the Farm (2nd Edition). MACK M. JONES. McGraw-Hill. 49*s*.

The first edition of this book came across the Atlantic about 1940, when a workshop on a farm in Britain was less common than it was in America, and it gave many people in this country their first idea of the variety of jobs that could be tackled in a farm workshop. This present edition has been brought up to date by including instructions in the use of modern machine tools, and of such useful accessories as the self-tapping screws for joining sheet metal.

Mack M. Jones is a thoroughly practical man. Thirty-six years ago he joined the staff of the University of Missouri as an instructor. He is now the professor of agricultural engineering, but the hints and information which he gives in this new edition of his book make it clear that he still spends some time at a bench and that he keeps abreast in his knowledge of the many new tools which make farm shop work so much easier than it was fifteen years ago.

Welding and work in the smithy are dealt with particularly well, and the chapter on the lathe gives very clear instruction. Not many farm mechanics use lathes, and the volume of work does not usually justify buying so expensive a machine for most farms, but the full-time mechanic on a large holding may be encouraged by this straightforward chapter to ask his employer to consider installing a simple lathe to make spare parts by turning and boring, to true up worn cylindrical surfaces, and to fashion screwed components accurately and quickly.

Woodworking is treated fully, and a chapter on rope work will appeal to farmers who make up livestock tackles. A long chapter describes how to sharpen workshop tools, axes and hoes, and the many other tools used on the farm.

The chapter on maintaining electrical equipment has some useful line drawings illustrating the methods of joining wires and making connections. The parts of the chapter referring to shock risks must, however, be read with the knowledge that mains electricity in America is usually supplied at 120 volts, compared with 240 volts in Britain.

H.J.H.

BOOK REVIEWS

British Wild Flowers. (2 Vols.) JOHN HUTCHINSON. Pelican Books. 5*s.* each.

The completion of Dr. Hutchinson's survey of the wild flowers of Britain and its publication now in systematic order in two volumes, instead of in three as formerly, will be welcomed alike by naturalists and by students of agriculture, horticulture and the biological sciences. Experienced and interested field workers have already had an opportunity of familiarizing themselves with the author's ideas on the classification of the families and genera of our flowering plants, so they are prepared to use a flora arranged to follow them. By frequent use of his keys, the relationship suggested by the author between closely allied plants becomes accepted, and the loyalty to Bentham and Hooker engendered by long familiarity is gradually weakened.

Younger naturalists are, rightly, less concerned with the subtleties of systematic relationship than with gaining a working knowledge of the wild plants in their neighbourhood or the localities they frequently visit, and here they will find this "Little Flora of Britain" a great help. The author's descriptions of the plants are given with a minimum of technical detail but he retains the characters that are essential for purposes of identification, and these he supplements with clear, precise drawings which emphasize the features that can be quickly detected with a little practice. Indeed, the work is within an ace of being "The Flora for Everyman". These two volumes will prove most useful to the amateur botanist, student or scientific worker, and those who have already used the companion book, *British Grasses*, will find the keys to the wild flowers equally serviceable.

The text which accompanies and extends the technical description of the species often gives some information about general distribution and a hint or two—usually guarded in the case of rarer species—about local distribution in Britain. This secrecy is unfortunately necessary if vandalism is to be avoided, but botanists are so mutually helpful that the earnest student will usually have little difficulty in finding a likely locality for a particular species he wishes to study.

Dr. Hutchinson's drawings are beautiful and will delight all but the hypercritical. If I were allowed to select a few for special commendation, they would probably be found in the several series containing the trefoils, vetches and clovers, and the crucifers in Volume I, and in the composites and amongst the monocotyledons in Volume II.

It is pleasant to think of the Martagon lily and the partridge berry (*Gaultheria*) finding places for themselves amongst our British flowers; the purists may frown but they are, after all, in a minority. Most of us welcome these attractive alien plants, and if on our expeditions we encounter them or other interesting species in unexpected places—as, for example, *Linnaea borealis* in a southern pinewood—we might well follow the author's suggestion and take off our hats as a gesture of delighted recognition.

H.W.M.

The Wirral Peninsula (Regional Books Series). NORMAN ELLISON. Hale. 18*s.*

Written in the clear and attractive style so reminiscent of the author's well-known broadcasts, *The Wirral Peninsula* conducts the reader on a leisurely tour of a very distinctive district. With forty years' experience of the countryside of which he writes, coupled with the keen powers of observation of the naturalist, it is not surprising that "Nomad" has produced an interesting book. Brief references here and there are, however, all that is given of the farming of the area, and the book will appeal more to the lover of the countryside than to the agriculturist.

As one would expect from a naturalist, Mr. Ellison is at his best when describing the birds, animals and natural flora which he has encountered, and it is therefore a little disappointing to find him mainly concerned in this book with the history of the district rather than with its wild life. But it must be admitted that the historical reference to the places he visits and the stories of the past connected with them make fascinating reading and will have a wide appeal. Moreover, the author has obviously been at some pains to establish the veracity of the stories of bygone days, and does not attach historical significance to interesting stories unless there is sufficient and reliable evidence to justify it.

The book is remarkable for its variety and great detail, including, as it does, such diverse subjects as the bird life of the Hilbre Islands, the meaning and derivation of the place names of the Wirral, and even an account of the ordeal which the district suffered by enemy bombing during the war. It has obviously been written by an enthusiast with a really intimate knowledge of the Peninsula.

R.H.

BOOK REVIEWS

Plant Propagation. R. C. M. WRIGHT. Ward Lock. 25*s.*

Plant propagation is of great interest to both the amateur and professional gardener, and a matter of fundamental importance to the commercial producer of plants. Every horticulturist recognizes it as a fascinating study made even more interesting and certain in recent years by improved methods and the use of newer materials. Here we have a volume bringing together modern technical information and practice. Mr. Wright draws generously on wide practical experience, and his clear, simple style will appeal to all.

The book covers a wide field. The early chapters are devoted to the principles underlying the production of plants from seeds, cuttings and the more exacting methods of budding and grafting. Further chapters deal with the ways of producing fruit trees, roses, etc., and later chapters give, in alphabetical order, the best methods of raising shrubs, alpines, herbaceous plants, greenhouse plants, etc. The latter section is no mere catalogue, for it includes practical notes on the selection of types of material, how and where to treat it, and what attention it will need. The author clearly recognizes the great difference between what is so often briefly stated and what is really meant. For example, many books tell us that *Tamarix* is propagated by cuttings; but Mr. Wright goes on to tell us how to select and plant the cuttings—which is exactly what we want to know.

But perhaps the book attempts to cover too much. Genetics is a very specialized subject and is best dealt with separately. Misstatements have also crept in. I cannot believe that "marrow seeds have been known to survive hundreds of degrees of frost"; nor are *Rosa canina* seed for stocks best sown in the open in spring. Stratification under moist, low temperature conditions is particularly important here. And the double form of *Gypsophila* is not a good example of a plant "which cannot be increased from cuttings", since we are told elsewhere that this method is used by nurserymen. And why are such splendid illustrations spoiled by those too thickly sown and spindly tomatoes shown on Plate 5?

In future editions I should like to see a short glossary of botanical terms and a bibliography pointing, in greater detail, to the more specialized information on seed storage, weed control in seedbeds, frame-working, etc. This would enhance the value of the book to the keen student.

These are, perhaps, minor criticisms of an otherwise excellent and orderly volume, well printed and produced. It has been written specially for the keen amateur and the professional, and will be read with pleasure and profit by students, gardeners and nurserymen alike.

J.N.

Rural Estate Management (3rd Edition). R. C. WALMSLEY. Estates Gazette. 37*s.* 6*d.*

The publication of a third edition of this work within seven years of its first appearance is a sure indication of its appeal to agricultural landowners, land agents and students of the profession. It is also a recognition of the continuing need to keep its subject-matter up to date in the light of the flow of legislation affecting property. Amendments necessitated by a further six statutes, passed since the publication of the second edition (1953), have been incorporated, and the opportunity has been taken to revise the extensive bibliography, which is such a valuable feature of the book. *Rural Estate Management* has, in fact, become an accepted manual in the profession, and its adoption as the general reference book for the examinations of the Land Agents' Society and of the Royal Institution of Chartered Surveyors (Agriculture and Land Agency Section) confirms its value to students.

Efficient rural estate management can make a substantial contribution towards reducing food production costs, which is so important for the future of British agriculture in a competitive world market, and this lucid and comprehensive study of the subject has no mean part to play in achieving that objective. Ranging in scope from a brief outline of the natural sciences and the many and varied legal aspects of the work, to details of managing land, houses and cottages, woodlands, sporting rights, minerals and the all-important finance, it provides an essential service for all concerned in the management of agricultural properties.

It is pleasing to record that the latest edition maintains the high standard set in the earlier editions, both by the authoritative treatment of the many subjects included as well as by the quality of production and the excellence of its index.

C.M.G.

Riding (" Play the Game " Series). MRS. V. D. S. WILLIAMS. Educational Productions Ltd. 7*s.* 6*d.*

In asking Mrs. Williams to write this book, the British Horse Society chose well, for she is an accomplished horsewoman and has given pleasure to many who have seen her ride her horse " Pilgrim ". She has equal ability with her pen, and her main points are clearly illustrated by Miss Joan Wanklyn's drawings. Many books have been written on riding and on the care of the horse, but few set out the essentials so clearly. Young riders, in particular, will appreciate a book containing so much and yet capable of being slipped in the pocket. Parents and others concerned with the often harassing task of selecting Christmas presents would do well to make a note of it.

Riding a horse has a charm of its own, and enjoyment increases with proficiency. A horse or pony well schooled and well cared for gives rich reward for the constant hard work. Mrs. Williams makes all this very clear in her book by her do's and don'ts.

The young rider of today has many advantages not enjoyed by his or her parents; there is the more tolerant attitude of the adult, there is the Pony Club, and there are many books to study and enjoy, and to the latter can now be added this informative little publication.

R.J.P.S.

First Steps in Farm Engineering. SEATRAIL. Farmer and Stock-Breeder. 7*s.* 6*d.*

This is another in the series of small practical manuals published by *Farmer and Stock-Breeder*, in this instance dealing primarily with elementary mechanics, the elements of machines, and associated subjects. It has been carefully prepared for those who have not had any special training in engineering. All that the reader needs is a basic knowledge of arithmetic, but he would be well advised to follow the simple rule given in the preface of starting at the beginning of the text and reading through to the end. Provided this is done, anyone who is not afraid of figures and diagrams should be able to understand most of the subject-matter.

The scope of the book is extremely wide. Chapters deal with all aspects of power and energy, acceleration and motion, friction, braking, beams and braces, belt and chain drives, gearing, hydraulics and lubrication. The method adopted is to start with everyday facts with which most readers will be familiar, and to explain the phenomena in terms of engineering principles.

In one or two chapters the reader who is taking his first steps in engineering may find some difficulty in understanding all that is written—for example, where calculations of strength of materials are considered—but this does not detract from the general value of a useful and well-presented little book.

C.C.

The Forester's Companion. N. D. G. JAMES. Blackwell. 12*s.* 6*d.*

In his daily work the forester, like the farmer or the engineer, has constant need of facts, figures, and formulae. Here, for the first time, he will find them neatly assembled in a volume he can slip into hisi pocket. This is hardly a text-book, for the information is too condensed to suit the student, but rather a reference book for the practitioner. Sponsored by the Royal Forestry Society of England and Wales, it has been diligently compiled by Mr. James who, as Land Agent to the extensive Oxford University estates, is a shrewd judge of the information really needed in the field. Much has been gleaned from Forestry Commission publications and other works of reference, but a great deal is original and reflects the author's long practical experience.

Herein you will find hints on the choice of trees to plant on different kinds of land, the formation of farm shelter-belts, the use of trees and shrubs in game coverts, and the various pests and diseases that may endanger forest trees of all kinds. Timber measurement, land surveying, and the marketing, saw-milling, and preservation of timber are all dealt with concisely. Details are given of financial grants available, both from the Forestry Commission and the Ministry of Agriculture, and the procedure for securing felling licences is also outlined. Everyone who owns or manages more than a few acres of trees will find this time-saving book a sound investment.

H.L.E.

BOOK REVIEWS

Elements of Soil Conservation (2nd Edition). H. H. BENNETT. McGraw-Hill. 28*s.* 6*d.*

There is no doubt about the importance of the subject and the competence of the author of this book. The soil is our fundamental asset, but it is only too easy to ruin it irretrievably by carelessness, greed or ignorance. This process has been going on to a greater or less extent wherever settled agriculture has been practised. Dr. Bennett's book, now in its second edition, deals exclusively with the sad story in the United States. The author has spent his working life on this problem and was for sixteen years the Chief of the Soil Conservation Service in the United States Department of Agriculture. Nobody has done more to point out the dangers of uncontrolled soil erosion, and, what is even more important, to seek the remedies and get them applied. The subject is dealt with exhaustively in his *Soil Conservation*, written in 1939. The aim of the present volume is to assemble the main facts for students and the agricultural public.

The basic ideas of soil erosion and conservation are suspiciously simple. Bare top soil is carried away by water or wind, as the case may be; this soil and water is a disastrous loss to the countryside and a menace everywhere else. It is only when the details have to be filled in that the complexities arise.

The first three chapters of the book set out the extent and effects of soil erosion. Together they act as a sort of shock treatment and are calculated to foster that sense of national and personal responsibility needed to sustain the costly and far-reaching measures to contain the problem and repair the damage. This section is supported by excellent photographs, which are more eloquent than words in showing what can happen in extreme cases. Much of the rest of the book describes the measures which can be taken to deal with these situations or, better still, to prevent them from occurring. Other chapters deal with related subjects such as drainage, irrigation and flood control.

A measure of the success attending the efforts of Dr. Bennett and other workers in the same field may be deduced from the fact that there are now some 2,500 soil conservation districts in the United States, where large blocks of country are being protected jointly by the occupiers and the Conservation Service.

The book is excellently produced, well indexed and includes a massive list of relevant pamphlets and films.

H.V.G.

Salisbury Plain. RALPH WHITLOCK. Hale. 18*s.*

This book captures the true atmosphere of this hub of ancient Britain in a manner only possible by one born and bred on the Plain and steeped in its lore. There is a lot about farming scattered between its covers, although only five pages are specifically devoted to it. This brief chapter, entitled " Modern Farming on the Plain ", gives a description of the transition from sheep and corn to the cows and corn of today, with a well-deserved mention of Mr. A. J. Hosier of Wexcombe. The rest of the farming is woven into a fascinating story of the ebb and flow of affairs on the Plain and the towns and villages nestling in its valleys, not forgetting Salisbury itself—true-to-life rural life in fact.

More than two thousand years ago mechanical devices were evidently already chafing at small fields, the heavier four-oxen plough replacing the two-oxen implement demanded a good long furrow, and those hillside lynchets of Wiltshire resulted. Modern farming may have its difficulties, but they are as nothing compared with the problems of those far-off days. After wrestling with a broken-down combine harvester, it may be some comfort to come in and read the following quotation from a farming poet of a more leisurely age:

From the strong planks our crab-tree staves rebound,
And echoing barns return the rattling sound.
In briny streams our sweat descends apace,
Drops from our locks, or trickles down our face.
No intermission in our work we know;
The noisy threshall must forever go.
Their master absent, others safely play;
The sleeping threshall does itself betray.

What volunteers for the flail these days!

R.E.R.

Animal Nutrition. E. J. SHEEHY. Macmillan. 30*s*.

This book has been written for the farmer who seeks guidance to help him select from the new scientific ideas and the new farming practices of the mid-twentieth century those that will help him reach higher outputs and more economic production. To him, as Professor Sheehy says, " there is no difference between the theory and practice of agriculture, good practice being the application of good theory ". For him, Professor Sheehy has sifted the mass of information on old and new science and on old and new practices and has achieved a satisfying synthesis of much pertinent knowledge into a variety of sound feeding systems.

Because of this, the title of the book is misleading, for the term " animal nutrition " carries with it an odour of the university and the research station. A more appropriate title would have been " Systems of Livestock Feeding ", since Professor Sheehy has gone far beyond the recording of scientific facts into the more difficult field of putting these facts to work in the feeding trough.

Much attention is given to methods of keeping the digestive tract in good health. This has long been a subject of special interest to Professor Sheehy in his own research, and he repeatedly emphasizes the importance of promoting healthy conditions throughout the gastro-intestinal tract by the proper selection of feedingstuffs, by appropriate preparation of feeds, and by good stock management. The losses incurred by farmers when scouring or " going off feed " causes setbacks in growth or production amply warrant the attention given to methods of avoiding them.

The feeding systems and the rations recommended are flexible. In most instances where typical home-mixed rations are recommended the opportunities of using alternative protein concentrates, of interchanging cereals, and of varying the proportions of the different kinds of milling offals are described. This gives the user the chance of taking full advantage of fluctuations in the market price of individual feedingstuffs to make the cheapest ration.

It is unfortunate that the book should be marred by the poor reproduction of the plates. In many the detail which the reader expects to find in the picture is only a blur.

J.D.

Directory of Wheel and Track-type Tractors. F.A.O. 15*s*.

An up-to-date and comprehensive directory of the wheel and crawler tractors produced by its member-countries has recently been published by F.A.O. The directory, which comprises 370 odd pages reproduced from typescript, contains the addresses of manufacturers and gives full specifications for all the models they produce. The information is given in three languages—English, French and Spanish—and both the metric and English systems are used in the specifications.

Copies of the directory may be obtained in the United Kingdom from H.M. Stationery Office, P.O. Box 569, London, S.E.1.

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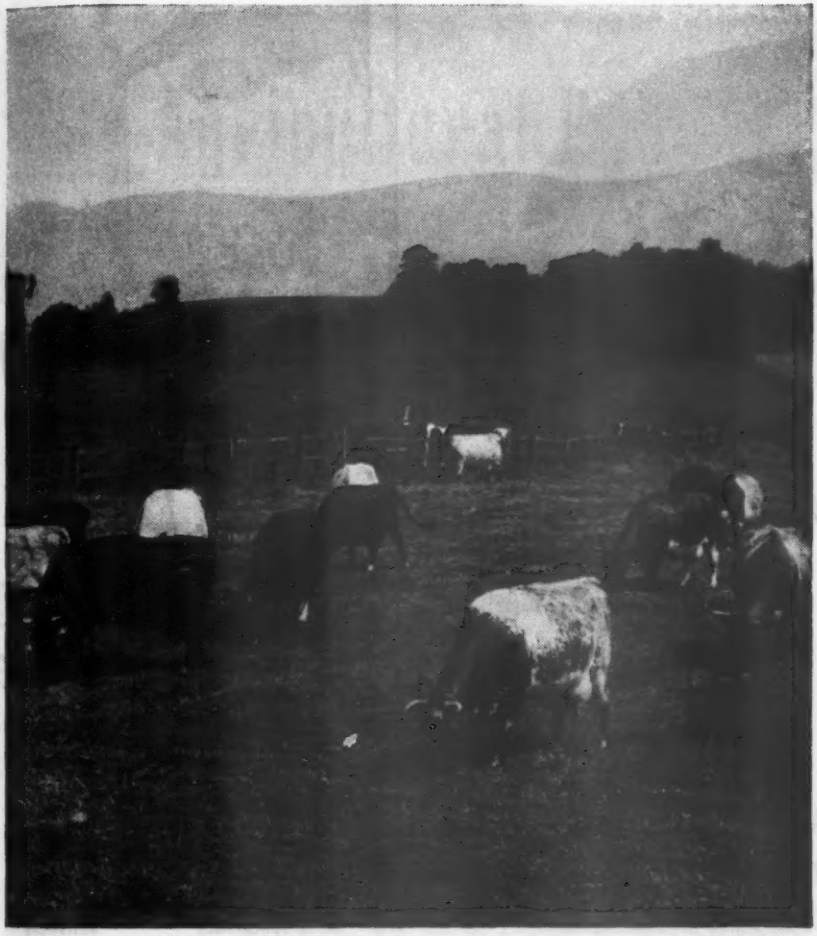

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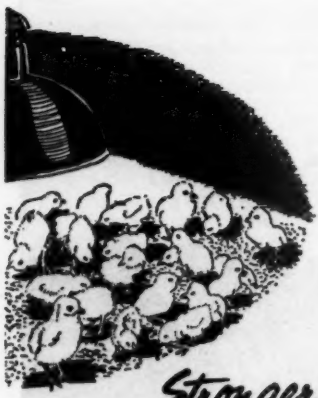

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The contributors to Agricultural Review are not just ordinary journalists, but the actual people who are making agricultural history. They give you an up-to-date picture of work in their particular fields. In the December issue, for instance, you will find an informed article on **mechanisation on the farm** in which Claude Culpin asks how much farther farm mechanisation is likely to go.

Dr. John Hammond, of Cambridge, tells the story of **artificial insemination** up to the present day. D. M. Cooper, from the Poultry Research Station, Houghton, Huntingdon, considers the position of A.I. in the turkey industry and summarizes latest research.

Animal disease—Ruth Allcroft, of the Ministry of Agriculture's Veterinary Laboratory at Weybridge, discusses the causes of hypomagnesaemia and various suggested remedies.

Everyone agrees that there is room for **improvement in the pig industry** but nobody is quite sure what line that improvement should take. Here Dr. Braude, of the National Institute of Research in Dairying, suggests the most favourable lines of development.

J. D. Findley, of the Hannah Research Institute, discusses the **effect of climate on cattle**, and gives some practical new advice on cattle housing.

H. A. Roberts, of the National Vegetable Research Station, examines **developments in weed killers** during the past year and gives his findings on the improvements made.

These are only some of the articles in the December Agricultural Review. There are also the regular monthly features—book reviews, conference reports, etc., and a comprehensive economic review prepared by the Economist Intelligence Unit.

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